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WORK PLAN

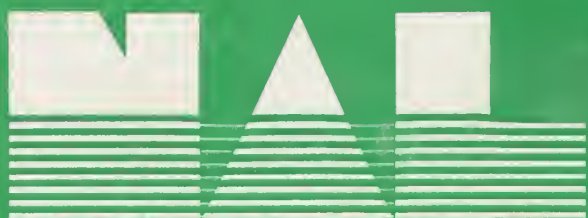
- FOR
- WATERSHED PROTECTION
- FLOOD PREVENTION
- MUNICIPAL WATER SUPPLY

POTEAU RIVER WATERSHED

SCOTT COUNTY, ARKANSAS AND LEFLORE COUNTY, OKLAHOMA

MARCH 1963

**United States
Department of
Agriculture**



National Agricultural Library

WATERSHED WORK PLAN AGREEMENT

between the

Poteau River Soil Conservation District
Local Organization

LeFlore County Soil and Water Conservation District
Local Organization

City of Waldron, Arkansas
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

States of Arkansas and Oklahoma

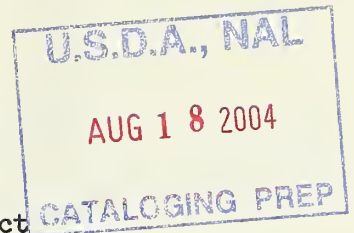
and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Poteau River Watershed, States of Arkansas and Oklahoma, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Poteau River Watershed, States of Arkansas and Oklahoma, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;



Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about five years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire without cost to the Federal Government such land, easements, or rights-of-way as will be needed in connection with the works of improvement. (Estimated cost \$ 380,700.)
2. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of works of improvement.
3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (Percent)	<u>Service</u> (Percent)	<u>Estimated Construction Cost</u> (Dollars)
Site 5			
Water Supply Inlet	100.00	0	22,000
All Other	34.17	65.83	311,000
All Other Structural Measures	0	100.00	2,970,932

4. The percentages of the cost for installation services to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (Percent)	<u>Service</u> (Percent)	<u>Estimated Installation Service Cost</u> (Dollars)
Site 5			
Water Supply Inlet	100.00	0	5,940
All Other	34.17	65.83	83,960
All Other Structural Measures	0	100.00	802,078

5. The Sponsoring Local Organization will bear the costs of administering contracts. (Estimated cost \$ 8,370.)
6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50% of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.
7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
8. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
11. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Sponsoring Local Organization prior to the issuance of the invitation to bid. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.
12. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

13. No member or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

Poteau River Soil Conservation District
Local Organization

By John Evans

Title Chairman

Date April 5, 1963

The signing of this agreement was authorized by a resolution of the governing body of the Poteau River Soil Conservation District

Local Organization

adopted at a meeting held on April 4, 1963

Mondell Owens
 (Secretary, Local Organization)

Date April 5, 1963

LeFlore County Soil and Water
Conservation District

Local Organization

By Ray Chaffin

Title Chairman

Date April 5, 1963

The signing of this agreement was authorized by a resolution of the governing body of the LeFlore County Soil and Water Conservation District

Local Organization

adopted at a meeting held on April 4, 1963

Anna V. Mingle
 (Secretary, Local Organization)

Date April 5, 1963

City of Waldron, Arkansas

Local Organization

By

Uma H. May

Title

Mayor

Date

April 11, 1963

The signing of this agreement was authorized by a resolution of the governing body of the

City of Waldron, Arkansas

Local Organization

adopted at a meeting held on

April 11, 1963O. K. Goodner

(Secretary, Local Organization)

Date

4-11-1963

Soil Conservation Service
United States Department of Agriculture

By

(Administrator)

Date

WORK PLAN
FOR
WATERSHED PROTECTION, FLOOD PREVENTION, AND
MUNICIPAL WATER SUPPLY

POTEAU RIVER WATERSHED
Scott County, Arkansas
LeFlore County, Oklahoma

Prepared Under the Authority of the
Watershed Protection and Flood
Prevention Act (Public Law
566, 83rd Congress, 68
Stat. 666), as Amended

Prepared By:

Poteau River Soil Conservation District
(Cosponsor)

LeFlore County Soil and Water Conservation District
(Cosponsor)

City of Waldron, Arkansas
(Cosponsor)

With Assistance By:

U. S. Department of Agriculture, Soil Conservation Service
U. S. Department of Agriculture, Forest Service
March 1963

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WATERSHED WORK PLAN

POTEAU RIVER WATERSHED
Scott County, Arkansas
LeFlore County, Oklahoma
March 1963

SUMMARY OF PLAN

General Summary

The work plan for the Poteau River Watershed was prepared by the Poteau River Soil Conservation District, the LeFlore County Soil and Water Conservation District and the city of Waldron, Arkansas, as the cosponsoring organizations. Technical assistance was furnished by the U. S. Department of Agriculture. The work plan proposes improvement of the watershed to be accomplished during a five-year period, at a total estimated installation cost of \$5,381,430.

The watershed covers an area of 187,460 acres in west-central Scott County, Arkansas, and east-central LeFlore County, Oklahoma. The 176,130 acres in Arkansas and 11,330 acres in Oklahoma are above Wister Reservoir. There are approximately 3,500 residents in the watershed area of which about 1,800 are rural and 1,700 live in towns. There are about 650 farms in the watershed, with 250 of these wholly or partially in the flood plain that is protected by the works of improvement.

The United States Forest Service administers 82,000 acres of Federal land in the Ouachita National Forest within the watershed.

The Poteau River has flooded an average of three times a year during the 20-year period, 1941 to 1960. The frequent flooding forced a change in land use from cropland to pasture.

Road and bridge damage is quite extensive. Floodwater damage occurs in the city of Waldron. Damaging sediment deposits affect a total of 3,171 acres. Flooding has caused scour damage on 3,564 acres of the flood plain. Waldron needs 1.75 million gallons of water a day to supply existing and future needs, approximately four times the existing supply.

Scott County has been declared eligible for assistance under the Area Redevelopment Act. The watershed project will reduce unemployment by providing water for expanded industrial employment. It can be expected that this development will benefit most of the people in the watershed.

The project is consistent with the President's directive and the Department of Agriculture's policy on soil and water conservation and rural area

development.

Land Treatment Measures

Forest land now occupies about 66 percent of the watershed for this reason, the land treatment measures which apply to this land use are essential to watershed protection. Proper treatment of the other land uses such as cropland, meadow, pasture, and range also are important. The cost of needed land treatment measures is estimated at \$796,450. This includes \$36,100 for additional technical help and \$7,800 for stabilization of critical areas. About \$752,550 will be provided from other sources.

Structural Measures

The structural measures consist of 18 floodwater retarding structures, one multiple-purpose structure, and 10.1 miles of stream channel improvement. The total estimated cost of the structural measures is \$4,584,980 of which Public Law 566 share is \$4,033,010, and the share from other sources is \$551,970.

Comparison of Benefits and Costs

The planned works of improvement will reduce the average annual floodwater, sediment, erosion, and indirect damages from \$145,314 to \$37,762, a reduction of 74 percent. The interrelated structural measures provide 93 percent of this reduction.

The average annual benefits accruing to structural measures are \$329,486, distributed as follows:

Flood Prevention Benefits

Reduction of Damages	\$ 99,922
Changed Land Use	15,112
More Intensive Land Use	30,152
Incidental Recreation	21,700
Nonagricultural Water Management Benefits	
Municipal Water	8,800
Redevelopment Benefits	129,300
Secondary Benefits	24,500
Total	<hr/> \$329,486

The ratio of average annual benefits accruing to structural measures (\$329,486) to average annual cost (\$145,515) is 2.3 to 1.

Provision for Financing Construction

The Poteau River Watershed Improvement District is being formed as a legal subdivision of the State with the powers of taxation and eminent domain. The improvement district will secure a loan from the Farmers Home Administration for the funds they will need in installing the 18 floodwater retarding structures and the stream channel improvement. That part of the installation cost of multiple-purpose structure 5, allocated to municipal water supply, and the entire cost of the inlet structure will be provided by the city of Waldron. The city has requested a grant from the Area Redevelopment Administration for the purpose of obtaining and processing the needed water.

Operation and Maintenance

The land treatment measures will be maintained by the landowners or operators of the farms on which the measures are installed under agreements with the Poteau River Soil Conservation and LeFlore County Soil and Water Conservation Districts. The Forest Service will maintain these measures on National Forest lands.

Under the terms of the operation and maintenance agreement to be executed, the 18 floodwater retarding structures and the 10.1 miles of stream channel improvement will be maintained at an annual cost of \$4,900 by the Poteau River Watershed Improvement District which is being formed. The city of Waldron will operate and maintain the multiple-purpose structure at site 5 at an estimated annual cost of \$370.

DESCRIPTION OF THE WATERSHED

Physical Data

The Poteau River rises in west-central Arkansas and east-central Oklahoma above Wister Reservoir, a Corps of Engineers project. The river flows north below Wister Reservoir to its confluence with the Arkansas River at Fort Smith, Arkansas.

The Poteau River watershed includes that part of the Poteau River which heads in west-central Scott County, Arkansas, and flows in a westward direction for about 37 miles until it enters the flood pool of Wister Reservoir about four miles west of the Arkansas-Oklahoma State line. Of the 187,460 acres within this watershed, 176,130 acres are in Scott County, Arkansas and 11,330 acres are in LeFlore County, Oklahoma. The principal tributaries are East Fork, Jones, Cross, Square Rock, Shadley, and Loving Creeks.

The topography ranges from low mountainous, with elevations up to about

2,640 feet above sea level along the northern boundary, to a gently rolling prairie-type landscape west of Waldron, where the general elevation is about 550 feet. The watershed lies in the Ouachita Highlands and Arkansas Valley Physiographic Regions. The major valleys and many of the minor valleys are developed along fault zones.

The watershed, roughly rectangular in shape, lies entirely within the Ouachita Highland land resource area and is underlain by shales, siltstones, and sandstones of Pennsylvanian Age. Soils of the upland range from moderately deep, medium-texture, slowly permeable to shallow, medium-textured, and gravelly to stony. Most of the soils are in the latter category. The soils within the flood plain are fine silty to sandy loams.

Water for livestock is supplied primarily from farm ponds. Wells and springs furnish the rural domestic water supply. The city of Waldron obtains its water supply from a surface impoundment. Water supplies are adequate for livestock and rural domestic use, but are not sufficient for municipal use or for development of recreational resources.

The present land use for the watershed is as follows:

<u>Land Use</u>	<u>Acres</u>	<u>Percent</u>
Idle	15,255	8.14
Cropland	11,365	6.06
Meadow	10,907	5.82
Pasture or Range	23,000	12.27
Woodland		
(Private 42,270 ac.)		
(Ouachita National)		
(Forest 82,000 ac.)	124,270	66.29
Miscellaneous <u>1/</u>	2,663	1.42
Total	187,460	100.00

1/ Includes farmsteads, roads, railroads, urban, etc.

Forest lands occupy 60 percent or 113,450 acres of the terrace and upland in the watershed. Of this total, 107,700 acres are in Arkansas, and 5,750 acres are in Oklahoma. The watershed contains 82,000 acres of Federal land in the Ouachita National Forest. Private ownership covers some 42,270 acres. Forest land is predominantly on terrace and upland areas.

The forest soils on the terrace area are poorly drained, medium- to fine-textured, and produce high runoff. This kind of soil supports 52 percent of the woodland area on the terrace. Farmers own 70 percent of the 54,880 acres of woodland on this area. Forest types are: pine and pine-hardwood, 45 percent; hardwood-pine, 17 percent; hardwoods, 35 percent; and red cedar,

3 percent. The hardwood component is poor to fair in quality with post oak, hard elm, hickory, and southern red oak predominating in the overstory in the order listed. Pine plantations make up 7 percent of the woodland.

An average of 1.8 percent of the area of woodland use on the terrace area has burned annually during the past 15 years. The burning is the result of carelessness. Moderate damage to the woodland has resulted from overgrazing. Merchantable volume is low.

About 69,390 acres of woodland are on upland soils. Federal land in the Ouachita National Forest comprises over 50,000 acres of this area, and forest industrial concerns own 6,000 to 7,000 acres. The forest soils are generally shallow and infertile. They contain large quantities of stone and gravel and frequently are underlain by impervious rock layers. The relative hydrologic conditions of these soils are: very poor, 12 percent; poor, 60 percent; fair, 24 percent; and good, 4 percent.

The forest types of pine and pine-hardwood predominate in the uplands. The hardwoods are generally of poor quality. Merchantable stocking is: 49 percent, well stocked; 38 percent, medium stocked; and 13 percent, poorly stocked. Merchantable stand size is: 4 percent, large sawtimber; 33 percent, small sawtimber; 51 percent, poles; and 12 percent, mostly unstocked.

Crop distribution on the 11,365 acres of cropland which is about equally distributed in the upland, terrace, and bottom land areas is as follows: row crops, 38 percent; small grain, 12 percent; and annual lespedeza and grass-legume mixtures, 50 percent. This distribution results in a hydrologic cover or condition of about 40 percent poor and 60 percent good.

The idle cropland area is composed largely of a good cover of broomsedge and other native grasses and legumes.

Meadowland areas are usually in permanent native grasses or sericea lespedeza, resulting in good hydrologic cover.

Tame pasture, locally a mixture of Bermuda grass and annual lespedeza, occupies about 50 percent or more of the open pasture land. The remaining pasture area cover is broomsedge, bluestem and other native grasses, and legumes.

Hydrologic cover on most of the pasture area is fair or better.

Crop distribution on the flood plain area is: cropland, 6.8 percent; meadow, 22.1 percent; pasture, 42.3 percent; idle, 9.3 percent; woodland, 18.7 percent; and miscellaneous, 0.8 percent.

Bobwhite and deer are the major wildlife resources of interest to sportsmen. Cover appears adequate for bobwhite, but feed sometimes is scarce. Deer are found mainly in and near the National Forest. Their range is limited somewhat by availability of water.

Based on the 22-year gage record (1931-1952) at Waldron, Arkansas, the average annual rainfall is 46.36 inches. The maximum and minimum annual rainfall for the above period is 70.78 and 35.47 inches, respectively.

The mean rainfall by months, in inches, is as follows:

January	3.91	July	2.95
February	4.18	August	3.34
March	3.94	September	3.41
April	4.43	October	3.50
May	5.52	November	3.50
June	4.46	December	3.22

Mean temperatures range from 42.4 degrees Fahrenheit in January to 80.4 degrees in July. The minimum temperature of record is 20 degrees below zero and the maximum is 109 degrees above zero. The normal frost-free period of 222 days extends from March 29 to November 6.

Economic Data

The major source of farm income in the watershed is from the sale of livestock and livestock products. Farm operations and cropping systems support this livestock industry. Until about 1935, the flood plain of Poteau River was farmed intensively and included a large acreage of cotton. Several cotton gins were located in the watershed at that time, but all of them have been abandoned. Cotton is produced only in the Oklahoma part of the flood plain.

Over two-thirds of the watershed is in woodland. Over 50 percent of the farm operators supplement their income by off-the-farm work, and the woodland area is a major source of employment.

For many years coal mining in the lower half of the watershed was a major source of income for the area but most of these mining operations have been abandoned.

Approximately 40 percent of the watershed is in farms. This is a higher percentage than for Scott County as a whole, which has only 25 percent in farms. There are about 650 farms in the watershed with 250 of these wholly or partly in the flood plain which will be protected by the project. The average size of these farms is 160 acres with an average value for land and improvements of \$7,100. This is an increase of over 60 percent in value and over 30 percent in the average size per farm in the last 10

years. The average value per acre for land and improvements increased from \$37 in 1950 to \$44 in 1960. This rate of increase lags behind the rate for agricultural land in the nation.

The watershed area is served by more than 200 miles of county and timber access roads and about 40 miles of paved highway, including 10 miles of U. S. Highway 71.

The Arkansas Western Railroad, extending from Waldron, Arkansas, through the watershed to Heavener, Oklahoma, hauls timber products and other heavy freight but provides no passenger service.

There are approximately 3,500 residents in the watershed area of which about 1,800 are rural and 1,700 live in towns. The population of Scott County declined by 25 percent during the last 10 years, but the population of Waldron increased by 25 percent.

The Arkansas Valley Industries, Inc., has promoted industrial development through the Arkansas Valley. In Scott County, the principal development insofar as the employment of labor is concerned, is a poultry processing plant operated by the Scott County Poultry Company, a subsidiary organization. This, and other industries, provide employment for over 300 people, but underemployment of labor remains a major problem. Scott County has been declared a "redevelopment area" due to the high percentage of low-income families and to substantial and persistent unemployment.

Differences in channel capacities and flood plain land use and the entrance of tributaries provide natural divisions of the flood plain. In following these, the flood plain was divided into five evaluation reaches on the main stem and six other evaluation reaches on the tributaries as follows: reaches 6 and 7 on Jones Creek; reach 8 on Ross and Square Rock Creeks; reach 9 on lower Ross Creek; reach 10 on Haw Creek; and reach 11, which includes minor tributaries - West Shadley, Twomile, Sixmile, Lookout, McNella, Loving, Cane, Cedar, Widow, Gum, and Cross Creeks. All reaches except reach 11 are shown on the Evaluation Reach Location Map (figure 4).

Land Treatment Data

The watershed is served by two Soil Conservation Service work units. The Waldron Work Unit is assisting the Poteau River Soil Conservation District in Arkansas, and the Poteau Work Unit is assisting the LeFlore County Soil and Water Conservation District in Oklahoma. The work units, through the districts, have assisted farmers and ranchers in preparing 525 soil and water conservation plans on 74,000 acres, or about 72 percent of the agricultural land, and in applying approximately 60 percent of the planned conservation practices. Agricultural land (102,797 acres) is defined as the total watershed (187,460 acres) minus the Ouachita National Forest (82,000 acres) and the area of miscellaneous use (2,663 acres) such as roads, urban area, and farmsteads.

The Arkansas Forestry Commission, in cooperation with the United States Forest Service is providing forest fire protection for the private woodlands of the watershed. The non-industrial private woodland owners on the project are furnished technical assistance by the Arkansas Forestry Commission, in cooperation with the United States Forest Service.

WATERSHED PROBLEMS

Floodwater Damage

The flood plain is that area inundated by the May 1960 flood of record, totalling 16,122 acres, excluding 270 acres of stream channel and 623 acres in the pool areas behind structures.

Poteau River has flooded frequently causing heavy damage to crops, fences, roads, and urban areas. During the 20-year period from 1941 to 1960, there was an average of over three floods per year of which one was a major flood inundating over 50 percent of the flood plain. The average annual area flooded because of recurrence exceeds the flood plain area by about 20 percent. Over 40 percent of the floods occurred during the early growing and planting season from April through June.

The greatest agricultural damage has been the forced change in land use from cropland to pasture and meadow. The farm operators have learned to live with the floods and keep their losses to a minimum by the use of temporary-type fences, and by the location of other improvements above the flood plain. Road and bridge damage is quite extensive and involves about 40 miles of roads and many bridges that are in the flood plain and subject to flood damage. Some minor damage to roads and bridges occurs at rather low flood stages, but no significant damage is caused by floodwater until approximately 30 percent of the flood plain is inundated.

Floodwater damage in the urban area of Waldron has, on occasion, been quite extensive. Overflows approximating the annual flood, or slightly larger, cause minor damage to some low-lying property. Travel may be disrupted in parts of Waldron and some persons may be out some expense preparing for deeper flows but, generally speaking, damage at this elevation will not be significant. Larger floods that cause damage of \$2,000 occur on the average of about every two years. This size flood was experienced in 1957.

The maximum storm of record, May 1960, inundated the entire flood plain and caused heavy damage to growing crops, pasture and improvements, and in the city of Waldron. This flood approximated a once in 20-year event.

Residential and business property was damaged most severely. Damages to streets and utilities were relatively minor although re-shaping of non-surfaced streets and removal of debris was necessary. This storm of

May 1960 is estimated to have caused \$145,000 direct floodwater damage; \$120,000 in the rural areas, and \$25,000 in the city of Waldron. Approximately 30 percent of the damage in the rural area was a result of damages to roads and bridges.

The estimated average annual direct floodwater damage to flood plain values, at long-term prices, is \$111,270 (table 5). Indirect damages, such as the interruption of transportation and travel causing loss of perishable farm products; additional expense due to rerouting of mail and school buses, and losses sustained by businesses in the area, are estimated at \$11,150 annually.

Sediment and Swamping Damage

The present damage by sediment deposition on the flood plain affects a total of 3,171 acres. This amounts to about 19.5 percent of the total flood plain area. The amount of damage is low, ranging from 10 to 20 percent, in terms of reduced productive capacity on the soils on which deposition has occurred.

In the past, sediment damages have been much greater. This area was thickly settled during the mid-1800's. Cultivation of clear-tilled crops, mainly cotton and corn, resulted in severe soil erosion on the upland which caused very severe damages from overbank deposition of infertile sediment. Conservation practices started in the 1930's, and adjustments in agriculture have resulted in a change from cropland to grassland and a general improvement of all cover in the watershed.

Due to the changed land use and improvement of cover condition, there has been a marked reduction in areas affected by sediment damage. The old deposits of clay, silt, and sandy loams, which range from one to eight feet in depth, are found over a large area of the flood plain. Most of these areas have recovered to a relatively high degree.

The Soil Conservation Service conducted a sedimentation survey in October 1961 on Lake Waldron, the water supply reservoir of the city of Waldron. The sediment deposited in the reservoir has averaged 1.97 acre-feet annually. This represents an average annual storage loss of 0.54 percent. The rate of sediment accumulation in farm ponds likewise has been low.

It is estimated, under present conditions, that 64.8 acre-feet of sediment is delivered annually by Poteau River into Wister Reservoir.

Swamping on a large area of the flood plain has caused major problems such as impeded surface drainage due to sediment-filled outlets and raised water tables. Approximately 2,829 acres have been damaged from 10 to 20 percent. About 60 percent of this land is found in reaches 2, 3, and 4.

Loss of productivity from new deposition and recovery of areas on which deposition has occurred appear to be approximately in equilibrium. In the absence of remedial measures to reduce sediment production and deposition, the annual sediment and swamping damage average about \$12,494. Present annual damage to Lake Wister from sediment is \$2,269.

Erosion Damage

Erosion rates are low throughout the watershed. The present weighted annual rate of gross erosion is only 1,176 tons per square mile. About 90 percent of this amount is from sheet erosion. The remainder is erosion from roads, roadsides, minor areas without vegetation, and streambanks. The minor un-vegetated areas are bare because of efflorescent gypsum, formed through evaporation of ground water at the surface. Flooding has caused scour damages on approximately 22 percent of the total flood plain area. This amounts to 3,564 acres of which about 60 percent has been damaged 10 percent, while 37 percent has been damaged 20 to 30 percent. The remaining 3 percent has been damaged 50 percent, and greater, in terms of reduced productive capacity. The average annual flood plain erosion damage without a watershed project is estimated to be \$8,130.

Problems Relating to Water Management

A very small part of the watershed needs drainage which can be accomplished with individual farm drainage systems. Irrigation of crops is of minor importance. No irrigation facilities are included in this plan.

The city of Waldron asked that municipal water storage be investigated. The need for additional water increased when the Scott County Poultry Company began operations at Waldron, Arkansas, in 1961. The poultry company requires large quantities of high quality water in processing and packing chickens. The company presented the following schedule for water needs to the city in May 1961:

September 1961	-	200 gpm for 8 hours per day
November 1961	-	400 gpm for 8 hours per day
December 1961	-	600 gpm for 8 hours per day
February 1962	-	800 gpm for 8 hours per day
July 1962	-	800 gpm for 16 hours per day
July 1964	-	1,260 gpm for 16 hours per day

A private engineer hired by the city made a study which showed that the present city impoundment on Square Rock Creek could be improved by raising the spillway 27 inches and installing a new pump. The recommended improvements increased the yield from about 200 gpm to about 370 gpm and the pump has a capacity of 525 gpm. The water supply, even with these improvements, would not meet the needs for the new industry.

Historically, upper Poteau River has often dried up during periods of drought with an almost complete loss of the existing fish population. Use of the area by ducks and geese is now limited, due principally to lack of large open bodies of waters. Ducks now stop at practically all of the existing farm ponds.

The watershed lies in an area with many advantages of scenery and climate. Undoubtedly, one of the chief reasons why the area has not become a center for tourism and recreation is the scarcity and uncertainty of surface water supplies.

PROJECTS OF OTHER AGENCIES

There has been considerable interest in development of soil and water resources in the Poteau River Basin.

The Corps of Engineers, in 1949, completed Wister Dam at river mile 60.9 on the Poteau River. The project was authorized by the Flood Control Act of 1938. The improvement consists of an earthfill dam about 5,700 feet long and rising 99 feet above the riverbed, with a reservoir storage of 400,000 acre-feet for flood control, and 18,000 acre-feet for recreation and preservation of wildlife; and 12,000 acre-feet for sediment reserve; a total capacity of 430,000 acre-feet. The Federal cost was \$10,501,000.

A report of the Arkansas-White-Red Basin Inter-Agency Committee, published as Senate Document No. 13, 85th Congress, presented a long-range plan for development of water and land resources of the basin. The plan included a Corps of Engineers proposal for reservoirs on tributaries below Wister Reservoir, and also a proposal by the Soil Conservation Service for development of floodwater retarding structures and land treatment measures, both above and below Wister Reservoir. Presently, there are eight Public Law 566 applications covering the entire area upstream from the town of Panama, Oklahoma. A comprehensive survey of the entire Poteau River Basin, in cooperation with the Corps of Engineers, has just been started by the Department of Agriculture, under Section 6 of Public Law 566.

BASIS FOR PROJECT FORMULATION

The sponsors of the watershed recognize the need for a comprehensive approach to the watershed problems. They are forming the Poteau River Watershed Improvement District, under Act 329 of the General Assembly of the State of Arkansas for 1949, as amended. The formation of the improvement district provides the means by which the landowners may collectively assume the local responsibilities under Public Law 566 and demonstrates the local group's ability and willingness to assume these responsibilities.

The local organizations and the Soil Conservation Service agreed to the following objectives:

1. To provide needed land treatment measures which will increase the efficiency of land use and obtain maximum benefits from the proposed improvements.
2. To reduce the area inundated by a 50 percent chance of occurrence flood by 60 percent and to provide protection to the main part of the city of Waldron from a one percent chance event.
3. To provide for the municipal storage of water.
4. To provide for the storage of water for recreational purposes and minimum basic facilities necessary to the use of this storage.
5. To provide the maximum feasible protection for fish and wildlife resources.

In the selection of locations for floodwater retarding structures, consideration was given to the topographic and geologic conditions as well as the location that would provide the most efficient protection.

The need for a high level of protection for the city of Waldron was recognized. Although good control on the East Fork of Poteau River could be provided, the topography prevented adequate control by floodwater retarding structures of the main stem of Poteau River above the city. Therefore, channel improvement was planned through the city of Waldron downstream to the confluence of Jones Creek. These features will provide adequate protection to Waldron from a flood with an average recurrence interval of 100 years.

Structure sites which will provide economical protection were found on Jones Creek and on one of its tributaries, Ross Creek. Good structure sites could not be located on Haw Creek, another Jones Creek tributary. The overall protection on Jones Creek is good. The channel improvement which started in Waldron is discontinued at the confluence with Jones Creek. Channel capacities are adequate downstream from this point.

The city of Waldron requested that the work plan include the addition of municipal storage at Site 6 upstream from their present impoundment. This site was given first priority for engineering field surveys, and an estimate of cost-sharing was furnished to the city.

Further analysis by the private engineer resulted in the recommendation

that another site be selected for adding municipal storage which would have a greater minimum yield than Site 6. The private engineer selected Site 5 and requested that 2,100 acre-feet be added for municipal use. The work plan includes the needed water storage.

The city has asked for a grant under the Area Redevelopment Act to cover their share of the cost of the impoundment and for the necessary delivery system, treatment facilities, and allied features.

The possibility of adding recreational storage to Site 15 on Jones Creek was studied during the planning stage at the request of the Arkansas Game and Fish Commission. It was found that the topography of the site would permit the construction of a multiple-purpose site for flood prevention and recreation, with a 240-acre recreation pool. The cost of adding the storage, acquiring lands, installing recreational facilities, and maintaining the improvements was found to be economically feasible. This feature has not been included in the plan since adequate local financing could not be arranged during the preparation of the work plan. When this problem has been resolved, it is expected that the recreation storage and facilities will be added as an amendment to this plan.

The measures included in the work plan, with the exception of recreational development, meet the objectives of the sponsors and provide for watershed development in keeping with the present and foreseeable future needs.

The work plan is consistent with (1) the President's directive on planning for water and related land resource development, and (2) the United States Department of Agriculture's policies on soil and water conservation, rural area development, and the strengthening of the family-farm pattern of agriculture. The social and economic welfare of the people of the watershed will be improved by the installation of the work plan features.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

An effective conservation program based upon the use of each acre of agricultural land within its capabilities and its treatment in accordance with its needs, such as is now being carried out by the Poteau River Soil Conservation District in Arkansas and the LeFlore County Soil and Water Conservation District in Oklahoma, is necessary for a sound flood prevention and water management program on the watershed. Basic to reaching this objective is the establishment and maintenance of all applicable soil and water conservation measures essential to proper land use. Emphasis will be placed on accelerating the establishment of land treatment practices which have a measurable effect on the reduction of floodwater, sediment and erosion damage.

The planned measures of cover and green manure crops, crop residue use, and grasses and legumes in rotation will improve ground cover and humus. Hayland planting, pasture proper use, and pasture planting will increase the farm income and also will provide for more soil cover and humus. The application of the contour farming practice will provide for better water control on land being used as cropland. These measures reduce downstream floodwater, sediment, and erosion and allow for a continuous and profitable agricultural use of the area.

Forest land now occupies about 60 percent of the watershed above the flood plain. For this reason the land treatment measures for these woodlands are important in the treatment of the watershed. Hydrologic stand improvement, tree planting, and critical area stabilization are important forest land treatment measures. Hydrologic stand improvement will include:

1. The interplanting or seeding to obtain full stocking.
2. The release of more vigorous growing stock from low vigor overburden.
3. The release or interplanting of the more valuable tree species which are better humus builders.
4. The conversion of poor low vigor stands to species capable of better site protection, improvement of hydrologic conditions, and greater productivity.
5. The control of woodland grazing.
6. The improvement of cutting practices.
7. Conservative logging and harvesting.

Certain land treatment measures, in addition to reducing floodwater, sediment, and erosion damage also will improve wildlife habitat. These treatment measures include the planting of Japonica lespedeza, sericea lespedeza, annual lespedeza, grass-legume mixtures, and food trees like sawtooth oak.

Approximately 40 acres of wildlife habitat improvement will be established. These plantings will provide appropriate food and cover requirements for bobwhites, rabbits, squirrels, doves, deer, and similar wildlife.

A concerted effort will be made to interest district cooperators in the development of feeding areas for ducks either on or adjacent to the floodwater retarding structures which are to be built. The construction of 200 farm ponds in the watershed not only will provide adequate watering places for livestock, which will implement proper use, and improved protection and maintenance of grasslands, but also will provide watering places for

wildlife. In addition to these functions, the farm ponds will be stocked with fish through the cooperation of the United States Fish and Wildlife Service.

Through technical assistance from the Soil Conservation Service, landowners above floodwater retarding and multiple-purpose structures will be encouraged to rotenone the headwaters to reduce wild fish populations.

The kinds, amounts, and estimated costs of the land treatment measures that will be installed by the landowners and operators during the 5-year installation period are shown in table 1. Installation and maintenance of land treatment measures will continue after the 5-year installation period.

Structural Measures

The structural measures consist of 18 floodwater retarding structures, 1 multiple-purpose structure, and 10.1 miles of stream channel improvement along the main stem of Poteau River. The multiple-purpose structure will be for flood prevention and municipal water supply. In addition to these project facilities, the city of Waldron will install a pumping plant and a 14-inch water supply line to deliver water to the filter plant.

The total drainage area behind the proposed dams will be 117.4 square miles, representing 40.1 percent of the watershed. A total of 623 acres of flood plain land will be covered by the pools of these structures. The permanent pools, including the areas reserved for sediment, and municipal water supply will inundate 272 acres of flood plain, and the detention pools will inundate 351 acres more. An additional 2,701 acres of upland will be involved in the structures.

The 19 structures will have an aggregate capacity of 49,254 acre-feet. This includes 2,100 acre-feet storage for municipal water in Site 5. The structures will have a total floodwater detention capacity of 42,766 acre-feet. The sediment storage provided will be adequate for 100-year accumulation. Floodwater detention capacity, expressed in inches of runoff from the drainage area above structures, is 6.70 inches. Runoff from the maximum storm of record, May 20, 1960, was estimated at 6.35 inches. Sufficient detention storage can be developed at all structure sites to permit the use of natural vegetative spillways.

Each floodwater retarding structure will include a drawdown slot and a drain valve in the principal spillway. These devices will permit manipulation of water levels for weed and mosquito control. They also will provide for fish management operation, exposure of shallow edges for waterfowl plantings, and the means to supply water downstream for emergency use.

The channel of Poteau River will be improved from its confluence with Jones Creek, upstream to a road crossing about one-half mile above the mouth of the East Fork of Poteau River. The improved channel will be designed to

carry release flows from structures 1 through 6 and flood runoff from the uncontrolled area. With the upstream structures, it will provide protection to the city of Waldron against significant damage from flooding that can be expected to have an average occurrence of once in 100 years.

The installation cost of floodwater retarding structures is estimated at \$3,725,280. The flood prevention channel is estimated to cost \$283,100 to install. The estimated installation cost of the flood prevention and municipal storage structure (Site 5) is \$576,600.

The structures are shown on figure 5, the project map, and reach locations on figure 4, the evaluation reach location map. Figure 1 shows a section of a typical floodwater retarding structure. Plans for a typical structure are illustrated by figures 2 and 2A. More detailed information on quantities, costs, and design features are given in tables 1, 2, 3, and 3A.

EXPLANATION OF INSTALLATION COSTS

The total installation cost of the project is estimated to be \$5,381,430, of which \$4,076,910 will be paid from Public Law 566 funds and \$1,304,520 will be borne by other funds. Included in total costs are land treatment measures, \$796,450, and structural measures, \$4,584,980.

Land treatment costs will be shared \$43,900 by Public Law 566 funds and \$752,550 by other funds. Other funds include \$29,500 for technical assistance through the regular program of Public Law 46. These funds are for making soil surveys (\$3,500), and for planning the installation of land treatment measures (\$26,000).

To accelerate the installation of the land treatment measures, Public Law 566 funds will pay \$10,000 for soil surveys, and \$20,000 for other technical assistance by the Soil Conservation Service; \$6,100 for technical forestry assistance on private lands by the Arkansas Forestry Commission, in cooperation with the United States Forest Service; and \$7,800 for stabilization of critical areas on National Forest land. United States Forest Service funds will be used with the \$7,800 of Public Law 566 funds for stabilization of critical areas on National Forest lands. The total cost of the measures on National Forest lands is \$15,600.

The total estimated installation cost for forest land treatment measures is \$280,600, of which \$192,700 will be spent on Federal land, and \$87,900 on non-Federal land. Technical assistance for private forest lands will be accelerated by the use of Public Law 566 funds in the amount of \$6,100. The remaining cost of technical assistance, \$4,300, will be provided by the Arkansas State Forestry Commission.

The Use of Facilities method was used to allocate joint costs between purposes in multiple-purpose structure 5.

As costs of installing pipelines, pumps, and the filter plant were not included as project costs but were deducted as associated costs from municipal water supply benefits, the only specific cost associated with municipal water supply in Site 5 was the cost of the inlet tower. The remaining cost was divided on the basis of capacities provided for flood prevention (65.83 percent), and municipal water supply (34.17 percent). The city of Waldron will bear all costs allocated to municipal water supply, and all costs of obtaining land, easements, and rights-of-way, and administering contracts.

All costs of floodwater retarding structures are allocated solely to flood prevention. Public Law 566 funds will pay all construction and installation service costs on these structures. The remaining costs will be borne by other funds.

Structural measure cost will be shared \$4,033,010 by Public Law 566 funds, and \$551,970 by other funds. The Public Law 566 funds will be spent for construction and installation service cost for 18 floodwater retarding structures, 10.1 miles of stream channel improvement, and part of the multiple-purpose structure. The cost-sharing responsibility results in the following distribution of cost:

Multiple-Purpose Structure 5 - Municipal Water and Flood Prevention

Public Law 566 funds will pay \$260,000 including \$204,730 for construction, and \$55,270 for installation services. Other funds will pay \$316,600, including \$152,800 for easements and rights-of-way; \$34,630 for installation services; \$128,270 for construction; and \$900 for administration of the contract.

Eighteen Floodwater Retarding Structures and Stream Channel Improvement

Public Law 566 funds will pay \$3,773,010; including construction costs, \$2,970,932; and \$802,078 for installation services. Other funds will pay \$235,370; including easements and rights-of-way, \$227,900; and administration of contracts, \$7,470.

All Structural Measures

Public Law 566 funds will pay \$4,033,010; including \$3,175,662 for construction costs; and \$857,348 for installation services. Other funds will pay \$551,970; including \$128,270 for construction; \$34,630 for installation services; \$8,370 for administration of contracts; and \$380,700 for easements and rights-of-way.

Included in easements and rights-of-way cost to be paid from other funds are \$88,200 for road and bridge relocation; \$8,000

for telephone line relocation; \$74,000 for power line relocation; \$15,000 for gas line relocations, and \$44,100 for removal of other obstacles from rights-of-way.

The engineer's cost estimate and contingency allowance of 10 percent is considered realistic, and provides reasonable allowance for unexpected costs.

The estimated schedule of obligations for the five-year installation period, covering installation of both land treatment and structural measures is as follows:

Schedule of Obligations				
Fiscal Year	Measures	Public Law 566 (dollars)	Other Funds (dollars)	Total (dollars)
First	Land Treatment	8,000	100,000	108,000
	Easements and Rights-of-Way	-	250,000	250,000
	Structures 2, 3, 4, and 5	869,240	165,070	1,034,310
Second	Land Treatment	10,000	180,000	190,000
	Easements and Rights-of-Way	-	130,700	130,700
	Structures 1, 6, 11, 12, and all Stream Channel Improvement	1,248,450	2,420	1,250,870
Third	Land Treatment	10,000	180,000	190,000
	Structures 13, 14, 17, 18, and 19	853,155	1,820	854,975
Fourth	Land Treatment	10,000	180,000	190,000
	Structures 7, 8, 9, and 16	632,450	1,320	633,770
Fifth	Land Treatment	5,900	112,550	118,450
	Structures 10 and 15	429,715	640	430,355
TOTAL		4,076,910	1,304,520	5,381,430

EFFECTS OF WORKS OF IMPROVEMENT

The project would reduce the area flooded by a storm such as that of May 18-20, 1960, from 16,094 to 11,048 acres; a reduction of 31 percent. Reductions would be greater on smaller storms. For example, the area inundated by a flood that can be expected once in three years on an average would be reduced about 55 percent. Major floods, inundating 50 percent or more of the flood plain, will be reduced from annual occurrences to events that can be expected on an average of about once in 5 years. Details of these reductions are shown in the following tabulation:

Effects of Works of Improvement

Evaluation : Reach :		Percent Chance of Occurrence and Acres Inundated											
		97 Percent		50 Percent		33 Percent		20 Percent		12.5 Percent		4.5 Percent ^{1/}	
(Figure 5) :		Natural	Modified	Natural	Modified	Natural	Modified	Natural	Modified	Natural	Modified	Natural	Modified
1		370	97	904	380	1,055	400	1,229	502	1,301	546	1,284	649
2 ^{2/}		680	61	1,620	512	1,710	685	1,823	1,031	1,886	1,222	2,035	1,570
3		63	0	1,540	328	1,790	540	2,049	1,255	2,170	1,540	2,346	1,865
4		220	74	1,975	885	2,410	1,240	2,802	1,898	2,913	2,210	3,112	2,695
5		5	0	1,212	600	1,406	915	1,509	1,235	1,535	1,378	1,583	1,492
6		30	0	322	8	427	11	585	30	667	61	837	127
7		26	0	346	15	513	26	888	48	1,020	80	1,235	187
8		203	79	550	280	659	386	788	537	853	620	1,009	818
9		24	0	430	4	522	8	660	24	715	35	790	66
10 ^{3/}		328	310	593	581	645	637	713	707	747	740	851	841
11		220	135	532	386	605	460	740	548	821	599	1,012	738
Total		2,169	756	10,024	3,979	11,742	5,308	13,786	7,815	14,628	9,031	16,094	11,048

^{1/} May 18-20, 1960 flood of record.^{2/} Modified by land treatment, structures, and channel improvement.^{3/} Modified by land treatment only.

Installation of the project would keep floodwater out of the main part of the city of Waldron if the one-percent chance flood should recur. The average annual area flooded in the city would be reduced from 285 acres to 120 acres, a reduction of 58 percent. Although the reduction in area flooded annually is relatively small, remaining damage will be insignificant. Major damage to property in Waldron does not begin until flood stage is three feet above bank full.

The area on which damaging sediment and swamping damage occurs will be reduced from 6,003 acres to 1,520 acres, a 75 percent reduction. Sediment deposition from the watershed in Wister Reservoir will be reduced from 64.8 to 38.1 acre-feet, annually, as a result of the project.

The area on which scour damages occur will be reduced from 3,564 acres to 1,275 acres, a 64 percent reduction.

After installation of the project, damage to roads and bridges in the flood plain will be reduced greatly. This reduction in flood hazard will enable the county to maintain roads in better condition, and will release funds from repair of damage to use for road and bridge improvement. As a result, transportation within the watershed will be much improved.

Protection provided by the project will enable farm operators to restore much of their flood plain land to profitable crop production. High value crops will replace some of the comparatively low value crops now grown because they are less subject to flood damage. It can be expected that much of the pasture will be improved through introduction of better grasses and heavier fertilization. Some of the woods will be cleared. No increase is expected in the acreage of cotton.

The proposed project will directly benefit 250 owners and operators of agricultural flood plain, and 33 business and residential units in Waldron.

Flood Prevention - The installation of the combined project of land treatment and flood prevention will reduce the average annual acreage flooded from 19,577 acres to 8,510 acres, a reduction of 57 percent. These reductions will range from 97 percent in reach 9, to only 4 percent in reach 10. These reductions are shown by reaches in the following tabulation:

Annual Area Flooded by Reaches

Reach	Average Annual Acres Flooded				Percent Reduction
	Without Project	With Project	Reduction		
Figure 5					
1	1,944	722	1,222		63
2	3,711	1,055	2,656		72
3	2,304	827	1,477		64
4	3,519	1,776	1,743		50
5	1,823	933	890		49
6	633	31	602		95
7	754	49	705		94
8	1,306	667	639		49
9	656	18	638		97
10	1,606	1,537	69		4
11	1,321	895	426		32
Total	19,577	8,510	11,067		57

Outdoor Recreation - Recreational use is now confined to limited farm pond fishing, sporadic fishing in the lower reaches of the upper Poteau River, and to hunting of small game, largely by local people. It can be expected that land treatment measures will enhance recreational opportunities. Each of the farm ponds will enhance the total fish production of the area. Plantings and other wildlife management practices will improve food, cover, and water facilities for bobwhites, doves, deer, and turkeys. However, no monetary evaluation has been made of their effect.

In the floodwater retarding structures, recreational benefits will be incidental to the use of the sediment pools. Fishing, followed by swimming, frog gigging, camping and picnicking, hunting and boating in descending order, will be the chief recreational uses of the sediment pools. It can be expected that as the sediment pools become filled with sediment, these uses will decline. After about 75 years, most of the use will have terminated. Recreation benefits also will be incidental to other purposes in multiple-purpose structure 5. Some restrictions will be needed on the use of this structure in connection with its use as a municipal water supply.

It can be expected that the sediment and the multiple-purpose pools will provide an annual yield of about 28,000 pounds of fish until filling has reduced the capacity of the sediment pools significantly.

The multiple-purpose structure, and the structures on National Forest land will be open to the public. The Forest Service has built a recreation lake on Cedar Creek, a tributary of the Black Fork of Poteau River. This installation has experienced outstanding public use. Analysis of the use of flood-water retarding structures in Six Mile Creek watershed indicates that a high percentage of sites in private ownership are open to the public without restriction, or by payment of only a small fee. Still other sites are leased to organized groups, or their use may be restricted to groups in the local community.

A somewhat similar use pattern can be expected in the Poteau River watershed. As population pressures increase and the demand for recreational facilities becomes greater, it can be expected that use of such facilities will expand markedly. Considering this increase in demand, the variety of sites available and their geographic distribution, it can be expected that visitor-days of use will average about 84,000, annually.

Municipal Water Supply - The consulting engineers estimated the benefits that would accrue from development of a municipal water supply. Their estimate was based upon the cheapest alternative source for a comparable supply. This would be a single-purpose water supply structure at site 5. The total benefits estimated included those necessary to offset the costs of installing, maintaining, and operating pipelines, filter plants, and other parts of the municipal system considered as associated costs. The remainder was allocated to the municipal water supply purpose of site 5.

Provisions of this water supply will meet the foreseeable needs of the city of Waldron so that its normal growth will not be inhibited by lack of high quality water.

Redevelopment - The Arkansas Valley Industries, Inc., has established an industrial complex in Scott County, the chief component of which is a poultry processing plant. Capacity is available in the plant for increased operations. The county has facilities for production of greater numbers of poultry. Underemployment of labor is such that ample local workers for increased production are at hand. The limiting factor is water.

The company has plans to expand its operations by adding another shift of workers during 1964 if water becomes available. It estimates that 165 new employees would be required in the plant. Associated industries, other than poultry producers, would need 14 additional employees. At prevailing wages, this would add more than \$465,000 to the annual payroll in the community.

However, it cannot be expected that Scott County will continue to be an area of significant unemployment, or underemployment, indefinitely. Consequently, it was assumed that this potential increase would accrue over only the first 20 years after project installation, and that thereafter - even without the project - there would be no significant underemployment. Furthermore, poultry prices are subject to great fluctuations, and the demand is affected greatly by the supply and price of other meats. In consideration of these factors, together with risks of poultry disease, and the probable normal loss of time by workers, through illness, vacations, and the like, it was decided that redevelopment benefits would be based on only 50 percent of the estimated potential. Even this amount would go far toward stabilizing the economy of Waldron, Scott County, and nearby areas.

Another source of redevelopment benefit is the use of underemployed or unemployed local labor in the installation, and operations and maintenance of the structural measures. While contractors usually provide their own experienced heavy equipment operators, they rely to a considerable extent on unskilled local labor. This is especially significant because in the watershed area, the unskilled labor, including small farm operators, suffers most from underemployment. Consequently, the employment of this local labor during project installation will provide an immediate stimulant to the economy of the area even before the processing plant is ready to expand operations. Likewise, the use of this labor in maintenance of structural measures will have a continuing steadying effect until the local economy has had a chance to function normally.

Secondary Benefits - Secondary benefits will accrue in the watershed and in the neighboring areas as a result of project installation and operation. Reduction of the flood hazard will permit farmers to utilize their flood plain more effectively, thereby providing a larger income base both for family living and trade development. Expanded agricultural development will require that more farm supplies be purchased. Reduction of flooding in Waldron will permit diversion of resources now used for repair of damage to activities that promote community growth. The recreational aspects of the project will stimulate tourist demand for food, lodging, and services and will increase the demand for recreational supplies and equipment. Expansion of production in the poultry processing plant will cause an estimated 50 poultry growers to begin production to meet the increased demand.

PROJECT BENEFITS

The estimated average annual monetary floodwater, sediment, erosion, and indirect damages (table 5) will be reduced from \$145,314 to \$37,762 by installation of the proposed project. This is a reduction of 74 percent, 93 percent of which will result from the interrelated structural measures.

The reduction of flood damages varies with respect to location within the

watershed. The locations of the damage reduction benefits attributed to the land treatment and structural measures are presented in the following tables:

		Average Annual Direct Damage ^{1/} (Dollars)					
Evaluation	:	Without	:	With	:	Percent	
Reach	:	Project	:	Project	:	Reduction	
	:		:		:	Reduction	
1		13,215		1,986		11,229	85
2		25,272		3,744		21,528	85
3		19,500		4,195		15,305	78
4		24,404		8,221		16,183	66
5		13,797		5,557		8,240	60
6		4,294		78		4,216	98
7		4,684		125		4,559	97
8		4,608		1,791		2,817	61
9		5,436		55		5,381	99
10		5,454		5,198		256	5
11		6,272		3,784		2,943	44
Total		127,391		34,734		92,657	73

^{1/} Does not include urban damage which was reduced from \$6,773 to \$268 annually, a 96 percent reduction.

		Direct Floodwater Damage - Urban (Dollars)										
		Frequency of Occurrence										
Item	:	2-Year		:	10-Year		:	25-Year		:	100-Year	
	:	Without:	With	:	Without:	With	:	Without:	With	:	Without:	With
	:	Project:	Project:	:	Project:	Project:	:	Project:	Project:	:	Project:	Project:
Urban Area		2,000	0		16,000	0		28,000	4,300		48,700	12,300
Percent Reduction		-	100		-	100		-	85		-	75

Had the project been installed at the time of the May 1960 flood, the damage within the city of Waldron would have been reduced from about \$25,000 to less than \$3,750.

Benefits from changed use of agricultural land and more intensive land use as a result of flood protection are estimated to average \$45,264, annually. Benefits accruing from restoration of flood plain land to its former productivity, amounting to \$22,462 annually, are included with those from reduction of crop and pasture damage in table 5. All of these benefits are attributable to structural measures. None of the enhancement-type benefits result from increases in acreage of cotton.

Incidental benefits from recreational use of the sediment pools of the 18 floodwater retarding structures, and from multiple-purpose structure 5, are estimated to approximate \$21,700, annually, over the project life. This estimate is based on a benefit accrual over 75 years converted to an annual equivalent for 100 years.

Total average annual benefits attributable to structural measures for flood prevention will average \$166,886. If incidental benefits were excluded, the amount would be reduced to \$145,186, annually.

The portion of the municipal water supply benefits from structure 5 allocated to this purpose average \$8,800, annually.

Since Scott County has been designated under the Area Redevelopment Act as an area of serious chronic underemployment, redevelopment benefits were calculated and used in project justification. The average annual value of redevelopment benefits is estimated at \$129,300.

It was not considered that secondary benefits from the National viewpoint were pertinent to project evaluation. Local secondary benefits were used in project justification. Such benefits resulting from the flood prevention and recreational features of the project will amount to about \$24,500.

It is estimated that primary benefits from the structural measures will average \$304,986, annually. Addition of the secondary benefits will raise the total to \$329,486, annually.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of the structural measures is estimated to be \$145,515. These measures are expected to produce average annual primary benefits of \$304,986, or \$2.10 for each dollar of cost.

The ratio of the total average annual project benefits (\$329,486) to the average annual cost of structural measures (\$145,515) is 2.3 to 1 (table 6).

PROJECT INSTALLATION

Federal assistance will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended. The Soil Conservation Service will provide technical assistance in planning, design, preparation of specifications, supervision of construction, preparation of contract payment estimates, final inspection, execution of certificates of completion, and related tasks for the establishment of the planned work eligible under Public Law 566.

Land treatment measures for watershed protection on privately owned land, itemized in table 1, will be established by the owners and operators. The

soil conservation districts, with technical assistance from the Soil Conservation Service, will assist in the planning and application of these measures. More technical assistance will be provided to enable farmers to apply the planned measures during the 5-year installation period. A part of the technical assistance will be to bring soil surveys up to an adequate intensity for use in applying the land treatment measures. It is estimated that re-mapping will be required on 110,000 acres.

The Arkansas Forestry Commission, in cooperation with the United States Forest Service, will assign a forester to the project for 13 man-months. The present Cooperative Forest Management Program will continue throughout the installation period.

The Forest Service will apply measures on National Forest land to retard surface runoff and to accelerate recovery of the deteriorated areas. The recommended measures are tree planting, hydrologic stand improvement, and critical area stabilization. Fifty acres of open land are designated for tree planting; 47,600 acres are designated for hydrologic stand improvement; 221 acres of critical areas are to be stabilized. Personnel of the Ouachita National Forest will provide technical supervision for installation of all these measures.

The Poteau River Watershed Improvement District is being formed under the authority of Act 329 of the General Assembly of the State of Arkansas for 1949, as amended, with the rights of eminent domain and taxation. The improvement district will be responsible for securing the necessary land, easements, and rights-of-way for all structures except the multiple-purpose structure. The improvement district also will provide necessary legal, administrative, clerical personnel, and needed facilities to carry out their responsibilities. They will advertise, award, and administer the contracts for 18 structures and stream channel improvement.

The city of Waldron will provide the following items in connection with the addition of municipal water supply at site 5:

1. All land rights needed for the site.
2. A part of the engineering services as set out in this plan.
3. Necessary legal, administrative, clerical personnel, and needed facilities.
4. Services needed to advertise, award, and administer the contract for the structure.
5. A part of the construction cost as set out in this plan.

Structures 1 through 6, and stream channel improvement were evaluated as a unit. It was found that benefits which they would produce would justify their cost even though installation of the remainder of the project were delayed. Therefore, they constitute a construction unit. All structures in the evaluation unit must be completed, or under construction, before construction begins in the remainder of the watershed. Structural measures will be installed during a 5-year period, pursuant to the following conditions:

1. Adequate land treatment above the structures has been installed, including the treatment of critical areas.
2. All land, easements, and rights-of-way have been secured for all structural measures in a construction unit before work is initiated on any part of the unit. In lieu of this requirement, a written statement may be made by the watershed improvement district which will be formed stating that its right of eminent domain will be used, if needed, to secure any remaining easements and that sufficient funds are available for the purchase of these easements and rights-of-way.
3. The contracting agencies are prepared to discharge their responsibilities.
4. Operation and maintenance agreements have been executed.
5. Federal funds are available.

The governing bodies of the Poteau River Soil Conservation District and the LeFlore County Soil and Water Conservation District will encourage farmers to establish complete soil and water conservation programs on their farms.

The Extension Service will assist with the educational phase of the conservation program through local meetings, radio and press releases, and other methods.

Through a cooperative arrangement with the United States Fish and Wildlife Service, the sediment pools will be stocked with the correct proportions of bass, bluegills, redears, and channel catfish. The 8 floodwater retarding structures, partially or wholly on National Forest land, will be managed for fish production under a cooperative agreement with the Arkansas Game and Fish Commission.

FINANCING PROJECT INSTALLATION

Federal help under authority of Public Law 566 is subject to appropriation of funds.

The cost of applying land treatment measures on private land will be borne by the owners or operators of the land, with financial aid from the Agricultural Stabilization and Conservation Service program, or other Federal and State programs. The county ASCS Committee has agreed to cooperate with the soil conservation districts by providing cost-sharing for practices needed in the watershed.

Technical assistance on private lands will be provided by the Arkansas Forestry Commission in cooperation with the United States Forest Service. Public Law 566 funds will be provided to accelerate the technical assistance program under a cost-sharing agreement. If the Arkansas Forestry Commission is unable to meet their cost for the first year, the entire cost for the first year can be borne by Public Law 566 funds. Costs will be shared during the remainder of the installation period.

United States Forest Service funds will be used to apply land treatment measures on Federal lands within the Ouachita National Forest except for \$7,800 of Public Law 566 funds for treatment of critical areas.

From information available, it is estimated that the greater part of the land, easements, and rights-of-way for the floodwater retarding structures and stream channel improvement will be donated. Any additional expense will be provided by the Poteau River Watershed Improvement District, which is being formed and will become a cosponsor of the plan. To provide funds for carrying out their obligation in the plan, the improvement district will secure a Farmers Home Administration loan. An assessment will be levied on the benefited area to repay this loan. A letter of intent will be sent to the Farmers Home Administration as soon as the improvement district is legally organized.

The city of Waldron will provide funds, through an Area Redevelopment Act grant, for its allocated share of the following items in connection with the addition of municipal water supply at site 5:

1. Engineering services.
2. Construction cost.
3. All necessary land, easements, and rights-of-way.
4. All facilities needed to transport, process, and distribute the municipal water stored at the site.

The soil and water conservation loan program of the Farmers Home Administration is available to eligible farmers within the watershed. Educational meetings will be held to outline available services and eligibility requirements.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

On privately owned lands, the land treatment measures will be operated and maintained by the landowners and operators of the farms on which the measures are installed. The operation and maintenance agreements will be between the individual farm owners and operators, and the Poteau River Soil Conservation District in Arkansas, or the LeFlore County Soil and Water Conservation District in Oklahoma.

The United States Forest Service will operate and maintain land treatment measures on Federal land within the Ouachita National Forest.

Forest fire protection on private land will be provided by the Arkansas Forestry Commission in cooperation with the United States Forest Service. The United States Forest Service will provide forest fire protection within the Ouachita National Forest. The degree of protection will be kept at its present high standard.

Structural Measures

The 18 floodwater retarding structures and 10.1 miles of stream channel improvement will be operated and maintained by the Poteau River Watershed Improvement District at an estimated annual cost of \$4,900. The necessary maintenance will be accomplished through the use of contributed labor and equipment, by contract, or a combination of these methods.

The city of Waldron will operate and maintain the multiple-purpose structure at site 5 at an estimated annual cost of \$370.

Representatives of the cosponsoring organizations will, after each heavy rain, or at least annually, make maintenance inspections of all works of improvement. A representative of the Soil Conservation Service will participate in these inspections at least annually. Items which may need maintenance that will be inspected will include, but will not be limited to, the condition of vegetative cover on the embankments and emergency spillways, the need for removing debris and trash from around the principal spillway, and the condition of fencing. The stream channel improvement will be included in this inspection to determine the need for control of vegetation, bank stabilization, and the removal of sediment and debris which affect channel capacity.

Provision will be made for free access of representatives of the cosponsoring local organizations and the Soil Conservation Service to inspect, and for the local organizations to provide maintenance for structural measures and their appurtenances at any time.

The cosponsoring organizations will maintain a record of all maintenance inspections made and maintenance performed, and have such information available for inspection by the Soil Conservation Service personnel.

The cosponsoring local organizations fully understand their obligations for maintenance and will execute specific maintenance agreements prior to the issuance of invitations to bid on the construction of structural measures.

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES
AND WATER SUPPLY RESERVOIR
Poteau River Watershed, Arkansas and Oklahoma

Item	Unit	STRUCTURE NUMBER									
		1	2	3	4	5	6	7	8	9	10
Drainage Area	Sq. Mi.	3.20	7.22	1.47	4.47	9.87	7.21	1.42	3.43	3.63	9.53
Storage Capacity											
Sediment											
Sediment Pool	Ac. Ft.	43	96	25	76	82	96	24	60	62	124
Sediment Reserve (Below Riser)	Ac. Ft.	43	96	25	77	82	81	24	60	64	125
Water Supply Pool	Ac. Ft.	-	-	-	-	102	-	-	-	-	-
Floodwater Pool	Ac. Ft.	28	62	16	48	92	31	16	40	41	81
Water Supply	Ac. Ft.	-	-	-	-	2,100	-	-	-	-	-
Floodwater	Ac. Ft.	1,193	2,312	628	1,909	3,687	2,963	529	1,189	1,219	3,556
Total	Ac. Ft.	1,307	2,566	694	2,110	6,145	3,171	593	1,349	1,386	3,886
Surface Area											
Sediment Pool	Acre	12	20	4	23	30	18	6	18	13	31
Sediment Reserve (Below Riser)	Acre	22	30	7	36	85	26	10	27	21	52
Water Supply Pool	Acre	-	-	-	-	262	-	-	-	-	-
Floodwater Pool	Acre	98	164	42	210	500	148	41	112	104	276
Volume of Fill	Cu. Yd.	200,186	267,245	150,010	153,290	231,090	309,585	66,627	156,950	165,168	96,529
Elevation Top of Dam	Foot	878.5	895.0	856.2	745.7	728.7	796.3	748.6	706.1	732.2	643.5
Maximum Height of Dam	Foot	40	49	54	38	47	65	39	38	43	44
Emergency Spillway											
Crest Elevation	Foot	874.3	890.4	851.5	741.4	724.1	791.3	745.1	701.7	727.8	638.5
Bottom Width	Foot	100	525	250	225	600	350	100	250	150	500
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Percent Chance of Use	2/	3.0	4.6	2.0	2.0	3.0	2.2	3.0	3.7	4.0	3.0
Average Curve No. - Condition II		77	77	77	77	77	77	77	77	77	77
Emergency Spillway Hydrograph											
Storm Rainfall (6-hour)	Inch	6.6	9.5	13.5	9.8	9.2	9.5	6.8	9.8	6.6	9.2
Storm Runoff	Inch	4.0	6.6	10.5	6.9	6.4	6.6	4.1	6.9	4.0	6.4
Velocity of Flow (V _c)	1/	0	0	4.0	0	0	0	0	0	0	0
Discharge Rate	1/	0	0	490	0	0	0	0	0	0	0
Maximum Water Surface Elevation	1/	-	-	852.4	-	-	-	-	-	-	-
Freeboard Hydrograph											
Storm Rainfall (6-hour)	Inch	16.4	20.8	33.8	21.4	20.3	20.8	16.9	21.6	16.3	20.4
Storm Runoff	Inch	13.3	17.6	30.5	18.2	17.1	17.6	13.8	18.4	13.2	17.2
Velocity of Flow (V _c)	1/	8.9	9.4	9.5	9.0	9.4	9.8	8.0	9.1	9.1	9.8
Discharge Rate	1/	2,195	13,700	6,766	5,300	15,500	10,100	1,615	5,850	3,575	14,895
Maximum Water Surface Elevation	1/	878.5	895.0	856.2	745.7	728.7	796.3	748.6	706.1	732.2	643.5
Principal Spillway											
Capacity - Low Stage	C.F.S.	71	128	34	100	483	143	35	73	77	206
Capacity Equivalents											
Sediment Volume	Inch	0.66	0.66	0.84	0.84	0.68	0.54	0.86	0.87	0.87	0.65
Detention Volume	Inch	7.00	6.00	8.00	8.00	7.00	7.00	7.00	6.50	6.30	7.00
Spillway Storage	Inch	2.60	2.30	2.69	3.48	3.13	1.92	2.93	2.93	1.98	2.59
Class of Structure		A	B	C	B	B	B	A	B	A	B

(See Footnotes on last page of Table 3.)

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES
AND WATER SUPPLY RESERVOIR - Continued
Poteau River Watershed, Arkansas and Oklahoma

Item	Unit	11	12	13	14	15	16	17	18	19	Total
Drainage Area	Sq. Mi.	12.08	6.53	4.96	2.13	13.64	7.92	3.12	3.58	11.96	117.37
Storage Capacity											
Sediment											
Sediment Pool	Ac. Ft.	161	84	71	25	217	106	45	63	163	1,623
Sediment Reserve (Below Riser)	Ac. Ft.	161	84	72	25	217	105	45	63	162	1,603
Water Supply Pool	Ac. Ft.	-	-	-	-	-	-	-	-	-	102
Floodwater Pool	Ac. Ft.	103	56	45	16	139	72	28	38	108	1,060
Water Supply	Ac. Ft.	-	-	-	-	-	-	-	-	-	2,100
Floodwater	Ac. Ft.	4,512	2,437	1,324	796	5,000	2,661	1,049	1,335	4,467	42,766
Total	Ac. Ft.	4,937	2,661	1,512	862	5,573	2,944	1,167	1,499	4,900	49,254
Surface Area											
Sediment Pool	Acre	40	14	16	6	45	21	9	20	53	399
Sediment Reserve (Below Riser)	Acre	64	21	23	9	73	31	14	30	82	663
Water Supply Pool	Acre	-	-	-	-	-	-	-	-	-	262
Floodwater Pool	Acre	328	100	103	36	298	173	75	123	393	3,324
Volume of Fill	Cu. Yd.	272,032	332,403	142,629	184,797	161,423	171,450	129,516	42,600	303,425	3,536,955
Elevation Top of Dam	Foot	847.4	861.5	776.4	802.1	735.8	685.7	757.4	788.7	817.4	xxx
Maximum Height of Dam	Foot	46	65	50	58	55	55	47	38	53	xxx
Emergency Spillway											
Crest Elevation	Foot	843.2	857.1	772.0	797.4	730.5	680.4	753.4	784.4	813.0	xxx
Bottom Width	Foot	250	200	212	100	500	175	100	100	250	xxx
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	xxx
Percent Chance of Use	2/	3.0	3.0	7.2	3.0	3.1	4.0	4.0	3.0	3.0	xxx
Average Curve No. - Condition II		77	77	77	77	77	77	77	77	77	xxx
Emergency Spillway Hydrograph											
Storm Rainfall (6-hour)	Inch	6.1	6.4	6.5	6.7	6.0	6.3	6.6	6.6	6.1	xxx
Storm Runoff	Inch	3.5	3.8	3.9	4.1	3.5	3.7	4.0	4.0	3.5	xxx
Velocity of Flow (V _c) 1/	Ft./Sec.	0	0	0	0	0	0	0	0	0	xxx
Discharge Rate 1/	C.F.S.	0	0	0	0	0	0	0	0	0	xxx
Maximum Water Surface Elevation 1/	Foot	-	-	-	-	-	-	-	-	-	xxx
Freeboard Hydrograph											
Storm Rainfall (6-hour)	Inch	15.2	15.8	16.1	16.7	15.0	15.7	15.2	16.3	15.2	xxx
Storm Runoff	Inch	12.1	12.8	13.0	13.6	11.9	12.6	12.1	13.2	12.1	xxx
Velocity of Flow (V _c) 1/	Ft./Sec.	8.9	9.1	9.1	9.5	10.2	10.2	8.7	9.0	9.1	xxx
Discharge Rate 1/	C.F.S.	5,715	5,455	4,895	2,650	15,806	5,566	2,036	2,230	5,250	xxx
Maximum Water Surface Elevation	Foot	847.4	861.5	776.4	802.1	735.8	685.7	757.4	788.7	817.4	xxx
Principal Spillway											
Capacity - Low Stage	C.F.S.	335	145	99	41	794	174	64	70	240	xxx
Capacity Equivalents											
Sediment Volume	Inch	0.66	0.64	0.71	0.29	0.79	0.67	0.71	0.86	0.68	xxx
Detention Volume	Inch	7.00	7.00	5.00	7.00	6.87	6.30	6.30	7.00	7.00	xxx
Spillway Storage	Inch	2.21	1.63	1.92	1.43	2.30	2.38	2.00	2.94	2.12	xxx
Class of Structure		A	A	A	A	A	A	A	A	A	xxx

1/ Maximum during passage of hydrograph.

2/ Based on regional analysis of gaged runoff and exceeds the minimum 6-hour volume set forth in Engineering Memorandum SCS-27.

3/ Exclusive of watershed from which runoff is controlled by other structures in series. Entire drainage area considered in design of the emergency and principal spillways.

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TABLE 4 - ANNUAL COST

Poteau River Watershed, Arkansas and Oklahoma

(Dollars)

Evaluation Unit	:Amortization:	Operation :	:	:
	: of :	and :	Other :	:
	:Installation:	Maintenance:	Economic:	:
	: Costs :	Costs :	Costs :	:
	: <u>1/</u> :	: <u>2/</u> :	: <u>3/</u> :	: Total
Floodwater Retarding Structures 1, 2, 3, 4, and 6; Multiple-Purpose Structure 5; Channel Improvement	60,432	2,870	15	63,317
Floodwater Retarding Structures 7 through 19	79,593	2,400	205	82,198
TOTAL	140,025	5,270	220	145,515

1/ Price Base: 1962 prices amortized for 100 years at 2.875 percent.

2/ Long-term prices as projected by ARS, September 1957.

3/ Estimated average annual production loss in Sites 3, 7, 9, 11, 12, 14, 15, and 16 which are wholly or partially on Federally-owned land.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Poteau River Watershed, Arkansas and Oklahoma

(Dollars) 1/

Item	:Estimated Average Annual Damage:			Damage
	: Without	: With	: Reduction	
	: Project	: Project	: Benefits	
Floodwater				
Crop and Pasture	59,216	14,751		44,465
Other Agricultural	13,168	3,615		9,553
Nonagricultural				
Roads and Bridges	32,114	8,957		23,157
Urban	6,773	268		6,505
Subtotal	111,271	27,591		83,680
Sediment				
Overbank Deposition	12,494	3,164		9,330
Wister Reservoir	2,269	1,334		935
Subtotal	14,763	4,498		10,265
Erosion				
Flood Plain Scour	8,130	2,913		5,217
Indirect	11,150	2,760		8,390
TOTAL	145,314	37,762		107,552

1/ Price Base: Long-term prices as projected by ARS, September 1957.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Poteau River Watershed, Arkansas and Oklahoma

Evaluation Unit	AVERAGE ANNUAL BENEFITS										Benefit-Cost Ratio	
	1/											
	Flood Prevention			Nonagricultural Water		Incidental Management		Recreation		Municipal Water		
	Damage	Changed	More	Intensive	Recreation	Municipal	Redevelop-	ment	Secondary	Total	Average Annual Costs	4/
	Reduction	Land Use	Land Use	2/	Water	Water	ment					
	Agricultural	Land Use	2/	Water	Water	ment						
Floodwater Retarding Structures 1, 2, 3, 4, and 6; Multiple-Purpose Structure 5; and Channel Improvement	40,447	3,063	9,418	11,400	8,800	114,770	4,950	192,848	63,317	3.0:1		
Floodwater Retarding Structures 7 through 19	59,475	12,049	20,734	10,300	-	14,530	19,550	136,638	82,198	1.7:1		
TOTAL	99,922	3/ 15,112	30,152	21,700	8,800	129,300	24,500	329,486	145,515	2.3:1		

1/ Long-term prices as projected by ARS, September 1957.

2/ Benefits from recreation are incidental to the installation of structures.

3/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$7,630 annually.

4/ From table 4.

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TABLE 7 - CONSTRUCTION UNITS

Poteau River Watershed, Arkansas and Oklahoma

(Dollars) 1/

Measures in Construction Unit	:	Annual Benefit	:	Annual Cost
	:		:	
<u>Unit 1</u>				
Floodwater Retarding				
Structures 1, 2, 3, 4, and 6;				
Multiple-Purpose Structure 5;				
Channel Improvement		180,300		63,317

1/ Price Base: Long-term prices as projected by ARS, 1957, for benefits and operation and maintenance, and 1962 prices for installation costs.

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INVESTIGATIONS AND ANALYSES

Forestry Investigations

A field survey was used to determine the forest conditions. Systematic sampling gave forest and hydrologic conditions and needed treatments. Information from State Forestry officials, other agencies, and past surveys fixed the amount of remedial measures recommended for the installation period. These measures include only those that contribute directly to flood protection and soil stabilization.

Hydrology and Hydraulics

The following steps were taken as a part of the hydraulic and hydrologic investigations and determinations:

1. Basic meteorologic and hydrologic data were tabulated from U. S. Weather Bureau Climatological Bulletins, U. S. Geological Survey Water Supply Papers, and selected daily gage charts for the Cauthron, Arkansas, stream gage. These data were analyzed to determine average precipitation, the historical flood series to be used in project evaluation of agricultural reaches, and runoff-peak discharge relationships.
2. Engineering surveys were made of 130 stream channel and valley cross sections of which 57 were on the main stem of Poteau River and East Fork, 32 on Ross and Jones Creek, and 41 on 14 minor tributaries selected to represent adequately the stream hydraulics, flood plain area, and the needs of the economist and geologist. Cross sections in the urban area of Waldron, Arkansas, were located to reflect a true water surface profile throughout the urban area, especially near buildings and establishments with higher damageable values where flooding probably would occur. A contour map was made of the urban area at 4-foot intervals to assist in locating the flood line for floods of various frequencies.
3. The present hydrologic condition of the watershed, excluding woodland areas mapped by the United States Forest Service, was determined by use of existing soil surveys, work unit land use and treatment records, and other pertinent information contributed by local area and work unit conservationists and soil scientists. Consideration was given to other factors such as geology, cropping practices, topography, soil cover, and climate.

The future hydrologic condition was developed from data furnished by the work units relative to expected changes in land use

resulting from an accelerated land treatment program during the project installation period. Present and future runoff curves were computed from the above data to determine rainfall-runoff relationships, and correlated with runoff volumes measured by the Cauthron stream gage. The 20-year historical flood series, coincident with the period of record of the Cauthron gage, was used in evaluation of agricultural reaches.

The concordant flow method was used to determine peak discharge-drainage area relationships, except for the Cauthron gage drainage area where available recorded peaks were averaged, and for drainage areas less than 50 square miles, such as above the Waldron urban area, where determinations were made by storage-indication routing.

4. Determination was made of peak discharges and areas inundated which would exist due to:
 - a. Present condition of the watershed.
 - b. Effect of all land treatment measures.
 - c. Effect of land treatment measures and floodwater retarding structures.
 - d. Effect of land treatment measures, floodwater retarding structures, and channel improvement on reach 2, and a portion of reach 1.

Stage-discharge-area inundated relationships for valley cross sections were developed by computing water surface profiles by Doubt's Method, using a digital computer program as outlined in Technical Release No. 14.

Discharge-area inundation curves were developed for each evaluation reach by summing the area flooded, by depth increments, for each cross section in the evaluation reach.

The hydraulic and hydrologic analysis for the urban area in Waldron was made by the synthetic frequency method to determine area flooded for the 100-year frequency and three smaller events.

The runoff volume-frequency data used as a basis for routing the above events through the urban area was developed from the Cauthron, Arkansas, gage record (1939-1960), adjusted to the urban area drainage area of 50 square miles and a storm duration of 8 hours, which equals or exceeds the time of concentration at this point. Runoff distribution is based on U. S. Weather Bureau TP-25.

Unit hydrographs were developed for each of the 5 site locations, and for 9 intervening areas pertinent to the 12 hydrologic routing reaches on the main stem of Poteau River and on East Fork upstream from the lower extremity of the urban area. Using the 6.35 inches estimated runoff from the May 18-20, 1960 flood of record, composite hydrographs were developed for each of the 14 indicated sub-areas. Figure 3 presents the unit hydrograph at valley section 37 for present and with project conditions. The urban area extends from valley section 37 upstream to valley section 43.

Storage indication curves were developed for the 12 routing reaches, and the 14 composite hydrographs for the flood of record were routed and combined at appropriate points to satisfactorily reproduce experienced stages at reference valley section 38, and at other locations in the urban area.

Composite hydrographs also were developed and routed, as indicated above, for the 1, 2, and 20 percent chance storms to determine flooding under present conditions in the urban area.

Routings similar to those indicated above were performed, starting with the 1 percent chance flood; assuming the structures in place; using the existing channel; and then re-routing with the improved channel assumed in place. Smaller floods were then routed until the point was reached where urban damages became minor.

Floodwater Retarding Structure Design - The detention storage volume, based on regional analysis of gaged runoff for multiple-day storms outlined by Hydrology Memorandum EWP-2 (AK-302) as a guide, equals or exceeds requirements in 12 of the 19 proposed structures, after allowance for a 20 c.s.m. maximum release rate. Storage in the remaining 7 structures approaches the Hydrology Memorandum EWP-2 (AK-302) values, and generally is considerably in excess of Engineering Memorandum SCS-27 minimum requirements.

Freeboard inflow hydrographs, computed using antecedent moisture condition II and future runoff curve number 77, were used to proportion structure emergency spillways since storage, except for Site 3, exceeded the emergency spillway hydrograph volume. Freeboard hydrographs were developed by the distribution graph method, using 1.25 times the 6-hour point rainfall shown in Figure 3.21-1, National Engineering Handbook, Section 4, Supplement A, for class (a) sites (design approaching class (b) site) 1, 7, 9, 11, 12, 13, 14, 15, 16, 18, and 19. Freeboard hydrographs were computed for class (b) sites 2, 4, 5, 6, 8, and 10 using 1.65 times the 6-hour point rainfall as outlined in Hydrology Memorandum EWP-3 (AK-303). Freeboard hydrographs for sites 17 and 3 were computed using 1.15 and 2.5 times the 6-hour point rainfall indicated in Figure 3.21-1, NEH-4, Supplement A. Emergency spillway designs for the structures were

obtained by graphical flood routing method No. 2, outlined in NEH-5, page 5.8-12. Minimum design criteria for all structures were exceeded with respect to volume of detention storage and runoff amounts used to design emergency spillways and top of dam elevations.

Storm of Record -Rainfall for the May 18-20, 1960 storm was 7.18 inches, resulting in estimated surface runoff of 6.35 inches.

An estimated peak discharge of 36,800 c.f.s. for this storm, under present conditions, occurred at reference valley section 20, Poteau River gage at Cauthron, (figure 5). After installation and full functioning of the measures proposed in this plan, the modified peak discharge at the same point for this storm would be 20,700 c.f.s., a reduction of 44 percent.

Present condition estimated peak discharge in the urban area of Waldron at reference valley section 38 is 22,650 c.f.s. After installation of all measures in this plan affecting the urban area, including channel improvement, the modified peak discharge for this storm is estimated at 11,200 c.f.s., a reduction of 50.6 percent.

The 100-year frequency, present condition, estimated peak discharge in the urban area at reference valley section 38 is 30,450 c.f.s. The estimated modified peak discharge for this storm at the reference cross section is 16,200 c.f.s., a reduction of 46.8 percent.

Water Yield - The city of Waldron employed a consulting engineering firm to prepare an engineering report for the purpose of recommending improvements to the existing water and sewerage system to meet the city's present and future needs. A copy of the report was furnished the Soil Conservation Service. The report was included as a part of the city's application requesting an Area Redevelopment Act grant for the needed improvement. The following excerpts are from the consulting engineering firm's report:

"The existing industry which has proven to be a large consumer of water is the poultry processing plant at the Northwest corner of the city. This plant is operated by Arkansas Valley Industries of which Mr. Harold Snyder is President. A . . . letter of May 24, 1961 from Mr. Snyder to Mayor Windham of Waldron . . . states that the designed production of this plant is 9,600 birds per hour, 16 hours per day At this requested rate of use the daily demand from this industry alone would be 1.21 mgd. Combine this 1.21 mgd with the city's expected 1990 usage of 0.50 mgd . . . (indicates that) 1.75 mgd is needed.

"By constructing a dam upstream from the existing impoundment (site 6) 1.0 mgd could be provided. This, however, does not meet even the presently desired usage. The only

means of obtaining the necessary water is therefore the construction of an impoundment on a larger watershed. Such a watershed is located on the East Fork of Poteau River.

"The water level of 712 (at site 5) will provide a lake with a capacity of 2100 acre-feet. As shown by the Mass Diagram in the Appendix this storage capacity will provide a firm yield of 1.75 MGD. This yield is for a design drought of 30 years".

The engineering report does not discuss the quality of the raw water, but provides for treatment facilities for processing the water at a reasonable cost. The poultry processing plant must use water of the highest quality, and the proposed facilities are designed to assure the availability of this type of water.

The water yield at site 14 will be adequate.

Geologic Investigations

Poteau River watershed is partly within the Arkansas Valley Physiographic Region, and partly within the Ouachita Mountain Physiographic Region of the Interior Highland Physiographic Province. The boundary is marked by the Choctaw thrust faults which follows the present course of Poteau River. This structure ends a few miles north of Waldron. East of this locality, the boundary is less well defined. The area to the north of the Choctaw fault is relatively stable with simply folded rocks in gently plunging anticlines and synclines. South of this major fault, intricately deformed rocks in steeply plunging folds cut by thrust faults are found. (A thrust or overthrust fault is one in which the rock formations are ruptured at a low angle and one section of the formation has slipped over the other section.) This is typical of the northern frontal belt of the Ouachita Mountains.

The major structural feature of the north part of the watershed is the Poteau syncline. This feature is topographically expressed by Poteau Mountain, whose elevations range from about 2,660 feet to about 700 feet above sea level in the gap north of Waldron through which U. S. Highway 71 passes. The north watershed boundary is located along the crest of this mountain. Two minor folds, the Hon anticline and the Waldron syncline, originate on the south limb of the Poteau syncline a few miles northeast of Waldron. In addition to these structures, there are several normal faults within this area; however, they affect only local areas.

The Choctaw fault is the northernmost thrust fault of the Ouachita Mountain region. For the most part, this fault is concealed by the alluvium of Poteau River; however, a good exposure of the upper thrust plate is evident in the NE 1/4 NW 1/4 Section 18, T. 3 N., R. 30 W.,

in a bend of the river. The Jones Creek fault joins the Choctaw thrust fault about two miles upstream from the mouth of Jones Creek and is a high angle tear fault. (A tear fault is one in which the rock formations are ruptured and the slipping has occurred in line with the fault zone, often causing considerable shattering of the rock along the fault zone). This fault forms the eastern end of the Choctaw thrust plate. Within the area of this thrust plate are numerous smaller tear faults, anticlines, and synclines. Near the southern boundary, the Ti Valley thrust fault is found. The Ti Valley fault is one of the more important faults of the Ouachita system. The Ross Creek fault is a branch of this fault.

The geologic formations making up the watershed, with the exception of the Pleistocene terrace materials found along the major stream and the more Recent alluvium, are Pennsylvanian in age. About four-fifths of the watershed is underlain by rock of the Atoka formation. This formation consists predominantly (up to 90 percent) of shales with interbedded siltstones and thin to medium-bedded sandstone. All sites, with the exceptions of sites 6, 7, 9, and 10, will be involved with the Atoka formation.

The next younger geologic formation is the Hartshorne. This formation crops out in a narrow band and forms a parallel ridge on the south flank of Poteau Mountain. While the massive sandstone beds, up to 15 feet thick, are the most obvious beds, silty shales make up about 75 percent of the formation. Sites 7 and 10 will be constructed on this unit of the Des Moines series.

The youngest Pennsylvanian formation that will involve structures 6 and 9 is the McAlester formation. It consists of about 80 percent shale and is exposed on the south flank of Poteau Mountain. Near the base of this formation is found the lower Hartshorne coal. This bed of coal has been mined by the use of strip methods in the vicinity of Bates, Arkansas, westward into Oklahoma. The sediment and flood pool, site 10, will back water over some of these strip pits.

Higher up on the south flank of Poteau Mountain, the Savanna formation is found. There is a possibility that the Boggy formation outcrops on the higher peak of Poteau Mountain north of Bates, Arkansas.

Preliminary geologic investigations were difficult to make, partly because of the disturbance of many of the beds, deep colluvial material on the abutments, fairly deep alluvial materials along the channels, and the presence of a good to excellent vegetative ground cover. However, a preliminary geologic investigation was made on each of the 19 planned structures within the watershed. These investigations included studies of lithology, stratigraphy, channel banks, abutment, ground water, and possible borrow areas. The materials of the borrow areas were classified in the field in accordance with the Unified Soil Classification System.

These investigations were conducted with a hand auger and indicated that the following conditions would exist at the structure sites within the watershed:

Foundation - Shales and thin to medium-bedded sandstones will be found in depths of up to 12 feet below the surfaces, and will be involved on each structure. Only at site 10 is any shaping of the abutments expected. This will be a small volume. While known faults will cross the centerline of sites 11, 13, and 19, other sites will possibly be affected by side faults. More deeply weathered zones, with an increased amount of excavation along the core trench, will be possible because of these faults. The faults do not exhibit any recent activity. However, the weight of a dam and impounded water might possibly reactivate movement where stress may be built up in the fault zones. For this reason, the most plastic materials available should be used to construct that portion of the dam overlying the fault. Also, the outlet conduit should be located on firm materials away from and not crossing a fault.

Emergency Spillway - The high degree of fracturing of the rocks due to the great amounts of stresses and strains in past geologic time will help account for the small amount of rock excavation thought necessary for these structures. It's believed that only at sites 1, 4, 7, 9, 10, 12, 14, 16, and 19 will rock be found and, of these, only on sites 9, 14, and 16 will there be any great amount.

Borrow Areas - Generally, the borrow material will be adequate in the sediment pools of the structures and the materials excavated from the emergency spillways; however, site 3 has only cobbles with SP and SM fine. Borrow for the cutoff trench and core will be found in a field on the right side and below the structures. This material is SC in the Unified Soil Classification. A high percentage of SC material is found in the sediment pool of all other structures.

Preliminary Recommendations - Detailed subsurface investigations will be made on all sites prior to design and construction. The use of a bulldozer for test pits will be useful on many of these sites.

Toe drains are recommended on each structure to intercept water seeping along bedding planes and joints beneath the structure, and to lower the phreatic line within the structure. The nearest source for this filter material will be Fort Smith, Arkansas. Rock riprap material, where needed on sites 4 and 5, will be manufactured locally.

Sedimentation Investigations

Sedimentation investigations were made in accordance with all applicable State, E&WP Unit, and National memoranda and technical releases. Field studies included surveys of the geology, physiography, and soils of the

watershed. Areas of overbank deposition, streambank erosion, and flood plain scour were investigated along selected typical valley sections, and the information obtained was expanded to the remainder of the flood plain. Tabular summaries of these findings were prepared as a basis for calculation of monetary damage by the economist.

A detailed reservoir sedimentation survey was conducted on Lake Waldron in October 1961. From the information obtained in this survey and from information on selected areas of various land use, a basic gross erosion rate in tons per acre was calculated for the watershed. In addition, sedimentation information from nearby Six Mile Creek watershed was used as a further guideline. A reconnaissance of each individual sub-watershed was made as to soil and land use. From these data, the gross erosion rate and sediment delivery rate to each structure was computed for 50- and 100-year periods. This was done to determine the elevation for the 50-year port in the principal spillway. Estimated future sediment production to the structures was left unchanged from the present due to the possibility of future degeneration of cover conditions within the drainage areas from fire, drought, and changed land use.

The annual sediment yield to Wister Reservoir was calculated, using data from sediment source studies above sites within each reach and expanded to the total drainage area within each reach. The resultant figure of 64.8 acre-feet delivered annually to the reservoir, under present conditions, compares closely with the U. S. Corps of Engineers suspended sediment load record on the Poteau River at Cauthron, Arkansas, as summarized in the Soil Conservation Service publication, "Rates of Sediment Production in the Western Gulf States," SCS-TP-127, March 1956. .

Economic Investigations

Flood Prevention

Determination of Benefits - Floodwater, sediment, and erosion damages were calculated under present conditions, and under conditions which will prevail after the installation of each group of measures. The difference between average annual damage at the time of initiation of each group of measures, and those after their installation, constitutes the benefits brought about by that group through reduction of damages. Benefits from reduction of damages were estimated from the effects of reduction in area and depth of flooding. The reduction in sediment production rates by land treatment, the area behind structures, and the estimated trap efficiency of the structures was considered in addition to the reduction of area flooded in estimating the reduction of overbank deposition. Indirect benefits were estimated to be 10 percent of floodwater damage reduction benefits. No damage reduction benefits were estimated for the pool areas of the structures.

Changed land use, restoration of productivity, and intensified land use benefits were calculated for all reaches adequately protected by structures. Consideration was given to future damage to the increased production and the added damage was deducted. All of these enhancement-type benefits are net benefits after production costs and associated costs have been deducted and adjustment made for a 5-year lag for installation. The lag for accrual of benefits from flood plain enhancement is based on a 5-year gradual build-up of production, a 4 percent interest rate, and a 100-year project life. The restoration of productivity benefits appear in table 5 as crop and pasture damage reduction benefits. An illustration of calculations of these kinds of benefits appear in table A.

Damage estimates for urban evaluation purposes were based on schedules obtained from owners and operators of flood plain property. The sample covered approximately 80 percent of the property damaged by the recent flood of 1960. A large sample was necessary since the need for determining the extent of flood plain enhancement required extensive investigation.

Information was collected on damages experienced from the floods of 1957 and 1960. Determinations were made also of the elevation where significant urban damage begins. At the same time, damage estimates were made for a flood which could be expected on the average of once in 100 years. It was determined that the elevation of the 100-year event flood would be about two feet above the 1960 flood.

Damage estimates for the experienced floods, and the estimates for the 100-year flood, were used to develop stage urban damage curves which, in turn, were applied to the synthetic series covering the entire range of damage-producing floods.

Field investigations revealed that enhancement of urban flood plain probably would not result from the proposed project. Even though the proposed floodwater retarding structures and the multiple-purpose structure will contribute materially in satisfying industrial demands and creating recreational opportunity, no assurance could be obtained that expansion of present industry into the flood plain is likely; nor could assurance be given that businesses associated with tourism would develop the flood plain. Furthermore, residential expansion into the flood plain does not seem likely since the labor required for expansion of present industry and project construction and maintenance is expected to be filled from local sources.

Recreational Benefits - Population trends and trends in the demand for recreation were analyzed. The Forest Service and the Arkansas Game and Fish Commission were consulted with regard to their experience in the use of recreational facilities. The history of recreational use of sediment pools in Six Mile Creek watershed was studied. The situation there was similar to that in this watershed, except that sites were not on public land, as are 8 of the floodwater retarding structures in this watershed.

Estimates of the average annual use in visitor-days were made on the basis of this analysis. Among the factors taken into account were recreational facilities available, distance from other similar facilities, accessibility, seasonal factors of use, and possibilities of public use.

In the economic analysis, sediment pools of the floodwater retarding structures were evaluated over a 75-year period because their effective life would be limited by sediment accumulation. A gross value of 50 cents per visitor-day was credited to use of sediment and municipal water supply pools. Associated costs such as installation and maintenance of access, removal of trash and debris, and similar items of cost were deducted in determining the net benefit.

Municipal Water Supply Benefits - Storage of water for municipal and industrial use was included as a purpose in this work plan. The "Engineering Report" on proposed water and sewerage improvements for the city of Waldron, submitted by Mickle-Daniel Associates, provides the basis for the benefit-cost analysis for municipal water to be stored in multiple-purpose structure 5.

Redevelopment Benefits - Recent construction experience in Arkansas and neighboring states was examined to determine the proportion of the contract cost expended in paying unskilled labor. In most cases this ranged from about 6 to 8 percent. It was felt that practically all of the unskilled labor used in this project would come from underemployed local sources. However, the nature of the sites is such that a higher than usual proportion of the cost will be for use of heavy equipment. Consequently, redevelopment benefits from this source were estimated to be only five percent of the contract cost. Redevelopment benefits from operation and maintenance of the structural measures were estimated at 50 percent of total costs for this purpose during the first 20 years after project installation. Heavy equipment normally will not be required for most of the maintenance.

Redevelopment benefits from expansion of production at the processing plant were based upon figures given by the company on increased employment and payroll. Adjustments were made to allow for less than the projected increase due to factors beyond the control of the company. These benefits also were calculated for a 20-year period. Both the benefits from plant expansion, and operation and maintenance of structural measures were converted to annual equivalents over the project life.

Secondary Benefits - The analysis of secondary benefits was based on primary benefits stemming from the project, together with increased costs of producing the additional goods induced by the project. A factor of 10 percent was used in each case, as set forth in Watersheds Memorandum SCS-57. Indirect primary benefits were excluded from consideration.

Furthermore, benefits from provision of a municipal water supply and redevelopment benefits also were excluded in estimating secondary benefits. It was felt that redevelopment benefits and secondary benefits from the municipal water supply were inseparable, and that to use them in the secondary benefit calculation would involve double counting some portion of the benefits.

Table A - Summary of Primary Benefits from Restoration,
Changed Land Use, and Intensification

Reach 5
Poteau River Watershed, Arkansas and Oklahoma
1961 Prices

Land Use	Unit	Acres	WITHOUT PROJECT			
	of		Yield	Gross	Produc-	Net
	Produc-		Per		tion	
	tion		Acre	Income	Cost	Return
				(dollars)	(dollars)	(dollars)
Corn	Bu.	97	40	4,500	3,104	1,396
Cotton	Lb.	47	400	6,618	4,533	2,085
Soybeans	Bu.	71	20	3,550	1,842	1,708
Meadow	Ton	348	1.5	10,910	6,003	4,907
Pasture	AUM	697	3.0	4,788	1,150	3,638
Woods	Dollar	222	1.75	388	-	388
Idle	-	95	-	-	-	-
Miscellaneous	-	6	-	-	-	-
Total		1,583	-	30,754	16,632	14,122

Land Use	Unit	Acres	WITH PROJECT			
	of		Yield	Gross	Produc-	Net
	Produc-		Per		tion	
	tion		Acre	Income	Cost	Return
				(dollars)	(dollars)	(dollars)
Corn	Bu.	140	40	6,496	4,480	2,016
Cotton	Lb.	47	400	6,618	4,533	2,085
Soybeans	Bu.	221	25	13,813	6,796	7,017
Meadow	Ton	110	2.0	4,598	2,668	1,930
Meadow	AUM	(110)	1.5	378	55	323
Meadow	Ton	260	1.5	8,151	4,485	3,666
Pasture	AUM	220	6.0	3,023	1,089	1,934
Pasture	AUM	477	3.0	3,277	787	2,490
Woods	Dollar	92	1.75	161	-	161
Idle	-	10	-	-	-	-
Miscellaneous	-	6	-	-	-	-
Total		1,583	-	46,515	24,893	21,622

Increased Net Return With Project - 1961 Prices		\$ 7,500
Increased Net Return With Project - Long-Term Prices		8,176
Discounted Increased Net Return (Gross Benefit)		7,563
Less Associated Costs		463
Less Additional Damage to Higher Values		965
Average Annual Benefit 1/		6,135
1/ Restoration of Production	\$ 1,753	
Changed Land Use	1,673	
Intensified Land Use	2,709	

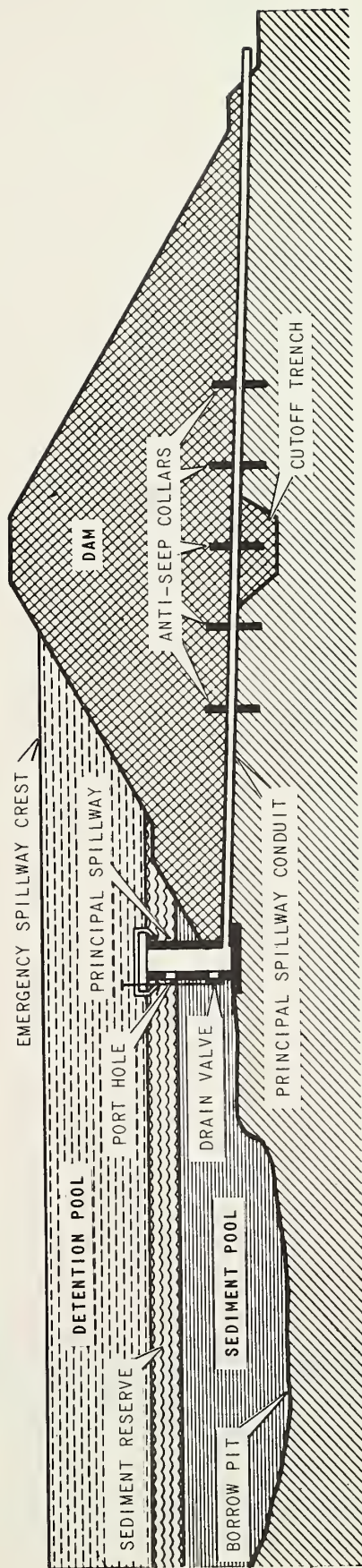


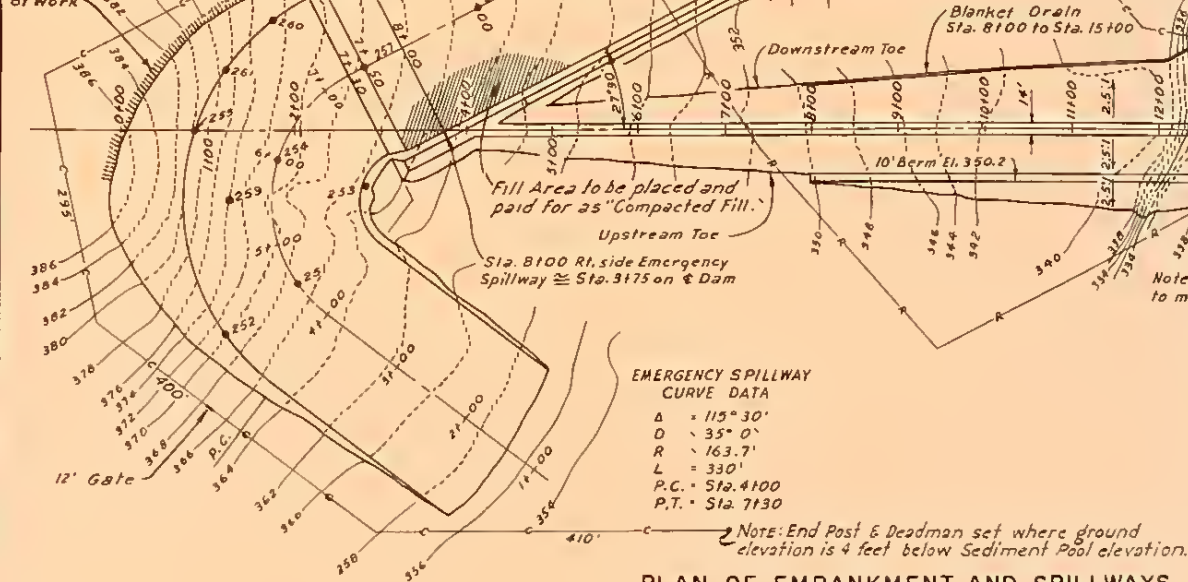
Figure 1
SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

A minimum of 6" of topsoil to be placed in emergency spillway and on all "compacted fill areas." See the specifications.

Stream Channel within embankment area to be cleared of objectionable material in accordance with "Stream Channel clean-out" of the specifications.

Spur Diversions:
Approx. 100 ft. long to be constructed at terrace intervals to divert runoff water away from Emergency Spillway Diversion from approx. Sta. 1150 to Sta. 7150. Not a pay item. Gully

Emergency Spillway Diversion: 18" effective height, 3:1 side slopes, minimum base - 13'. Cost of Diversion to be subsidiary to other items of work

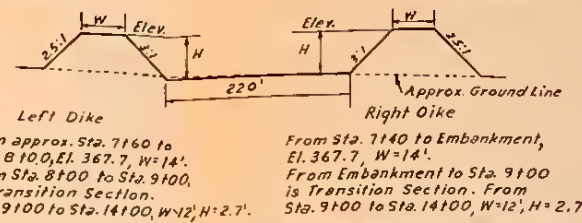


EMERGENCY SPILLWAY CURVE DATA
 $\Delta = 115^\circ 30'$
 $D = 35^\circ 0'$
 $R = 163.7'$
 $L = 330'$
 $P.C. = Sta. 4100$
 $P.T. = Sta. 7130$

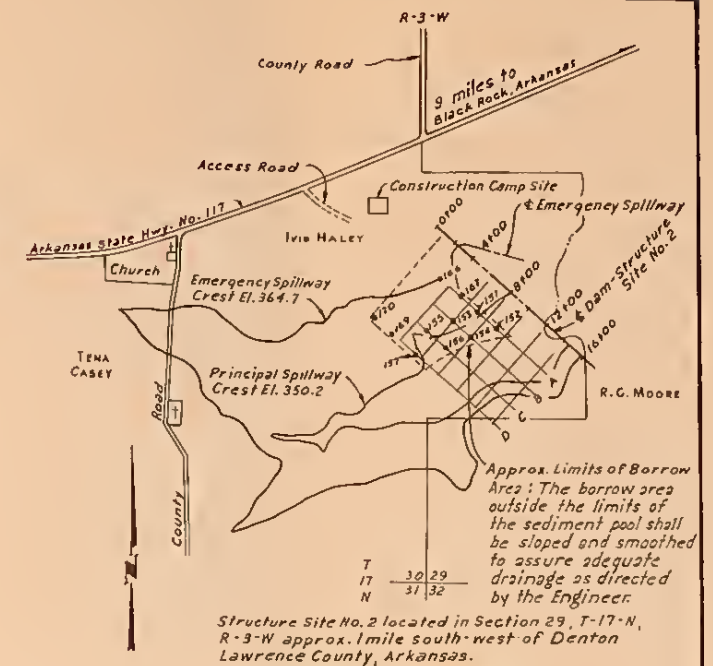
Note: End Post & Deadman set where ground elevation is 4 feet below Sediment Pool elevation.

PLAN OF EMBANKMENT AND SPILLWAYS

SCALE IN FEET
 0 697 1394 1891 2788 3485

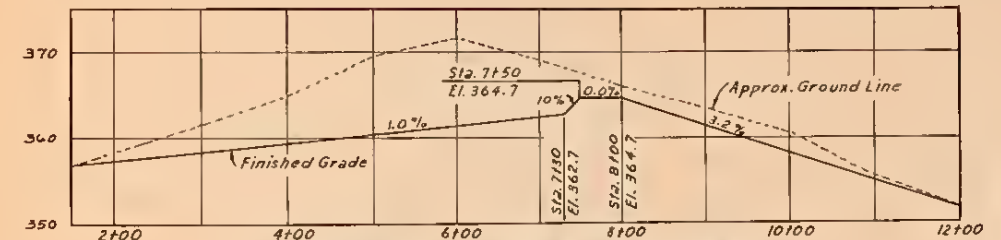


TYPICAL SECTION EMERGENCY SPILLWAY

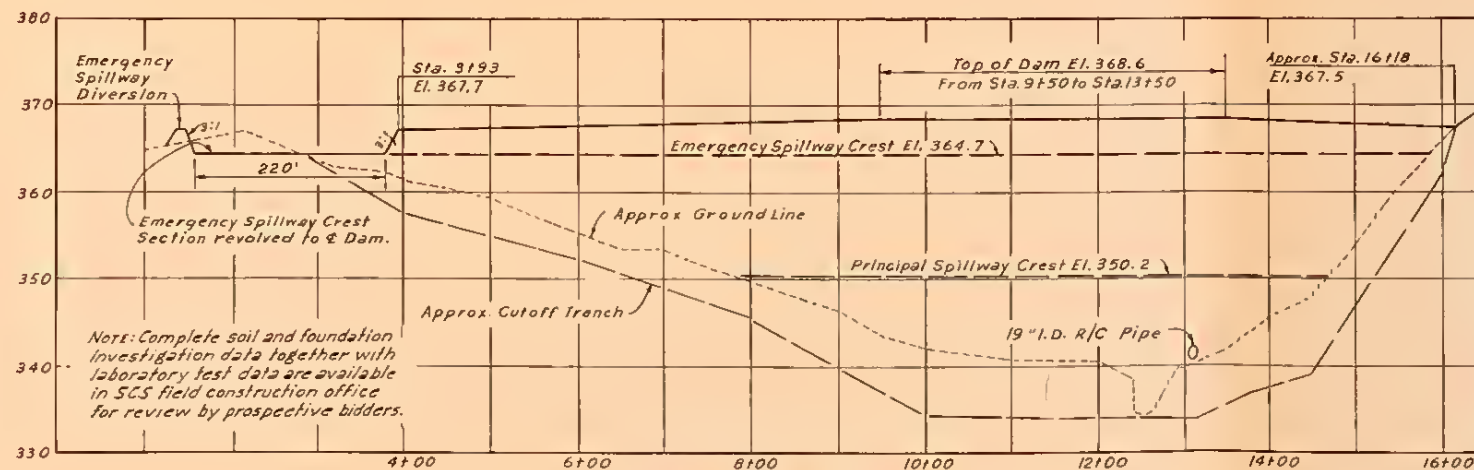


VICINITY MAP AND GENERAL PLAN OF RESERVOIR

SCALE IN FEET
 0 697 1394 1891 2788



PROFILE ON C OF EMERGENCY SPILLWAY



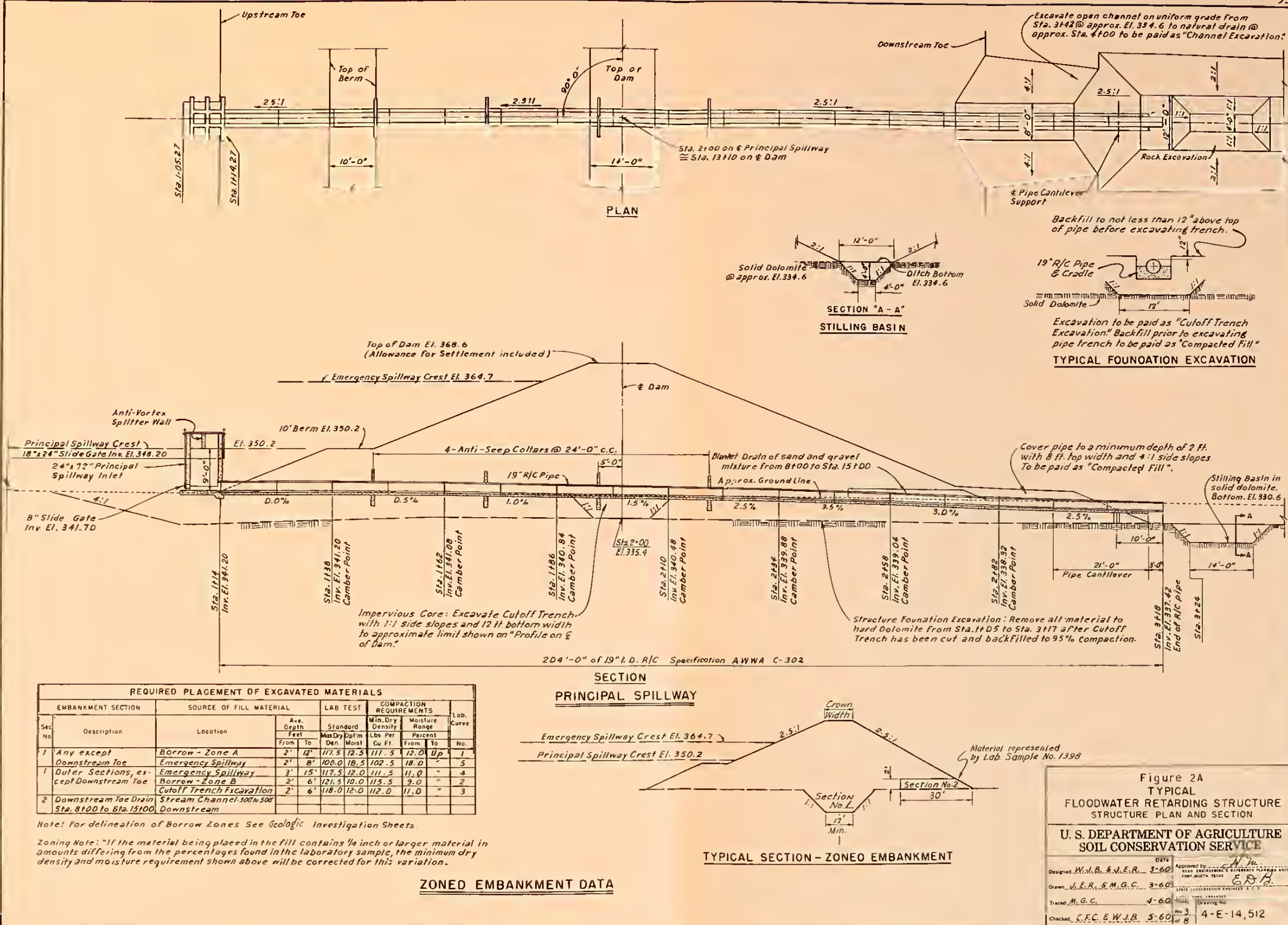
PROFILE ON C OF DAM

ELEVATION	SURFACE ACRES	STORAGE ACRE FEET	INCHES
335.0	0	0	0
338.0	1.1	0.8	0.01
342.0	4.8	12.6	0.11
346.0	12.5	47.2	0.40
350.0	21.0	114.2	0.96
350.2	21.6	119.0	0.98
354.0	30.8	217.8	1.84
358.0	52.4	384.2	3.24
362.0	74.6	638.2	5.39
364.7	86.0	846.0	7.14
366.0	91.9	971.2	8.20
368.6	101.2	1225.0	10.35
Top of Dam (Effective) Elev.			367.5
Emergency Spillway Crest Elev.			364.7
Principal Spillway Crest Elev.			350.2
Sediment Pool Elev.			350.2
Drainage Area, Acres			1422
Sediment Storage, Acre Feet			135
Floodwater Storage, Acre Feet			711
Max. Emergency Spillway Cap. cfs			3694

Figure 2
TYPICAL
FLOODWATER RETARDING STRUCTURE
GENERAL PLAN AND PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by W. J. B. & J. E. R. 3-60
 Drawn by W. J. B. & M. G. C. 3-60
 Traced by M. G. C. 4-60
 Checked by C. F. C. & W. J. B. 5-60
 Date 3-60
 Sheet 2 of 8
 Project No. 4-E-14,512



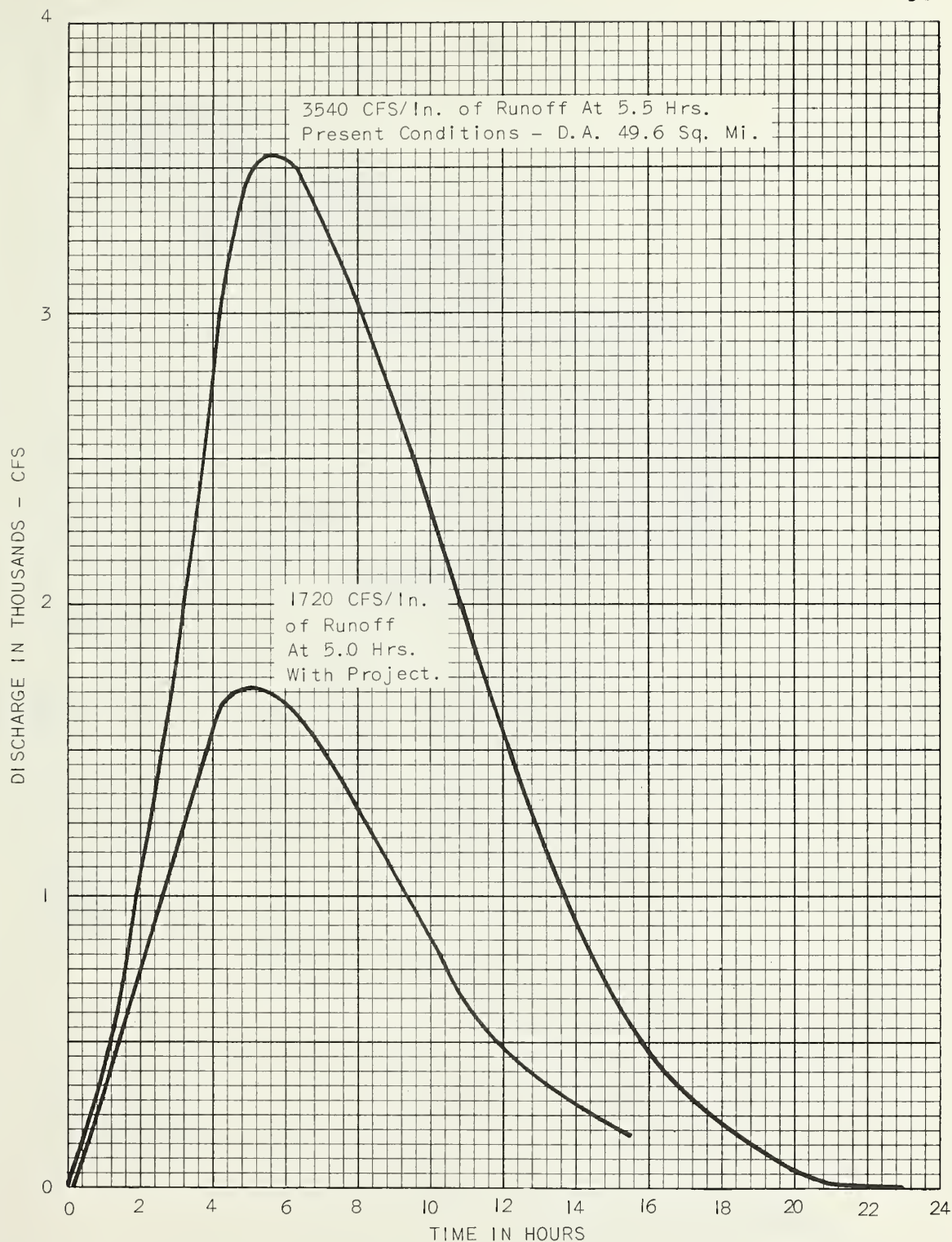
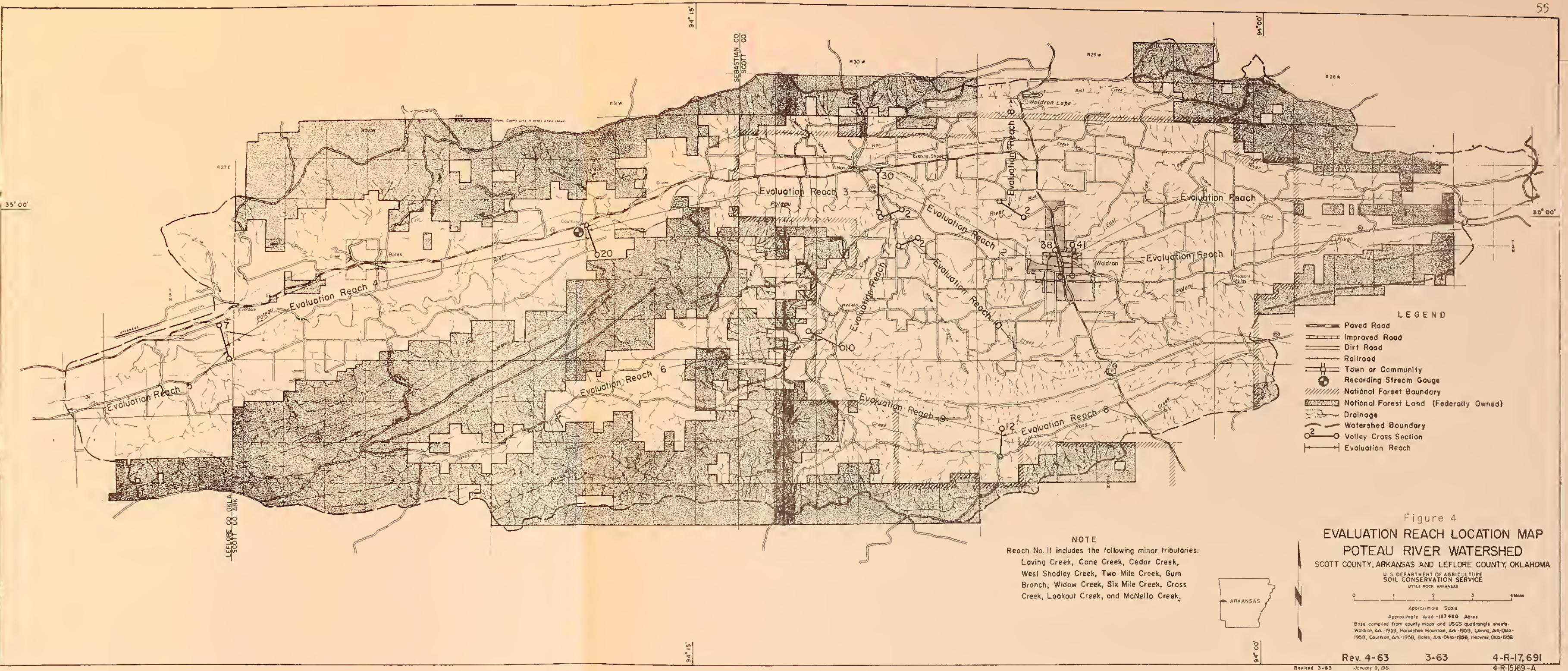


Figure 3
 URBAN AREA UNIT HYDROGRAPHS
 WITH AND WITHOUT PROJECT
 VALLEY SECTION 37
 POTEAU RIVER WATERSHED
 SCOTT CO., ARK. and LE FLORE CO., OKLA.



- LEGEND
- Paved Road
 - Improved Road
 - Dirt Road
 - Railroad
 - Town or Community
 - Recording Stream Gauge
 - National Forest Boundary
 - National Forest Land (Federally Owned)
 - Drainage
 - Watershed Boundary
 - Valley Cross Section
 - Evaluation Reach

NOTE

Reach No. 11 includes the following minor tributaries:
Loving Creek, Cone Creek, Cedar Creek,
West Shodley Creek, Two Mile Creek, Gum
Branch, Widow Creek, Six Mile Creek, Cross
Creek, Lookout Creek, and McNetto Creek.

Figure 4
EVALUATION REACH LOCATION MAP
POTEAU RIVER WATERSHED
SCOTT COUNTY, ARKANSAS AND LEFLORE COUNTY, OKLAHOMA

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

Approximate Scale
0 1 2 3 4 Miles

Approximate Area - 187,460 Acres

Base compiled from county maps and USGS quadrangle sheets:
Waldron, Ark. - 1939, Horseshoe Mountain, Ark. - 1950, Lanning, Ark. - 1950,
1950, Couthron, Ark. - 1950, Bates, Ark. - 1950, Heavner, Okla. - 1950.

35° 00'

94° 15'

SEBASTIAN CO
SCOTT CO

94° 00'

65° 00'

LEFLORE CO-OKLA
SCOTT CO-ARK

94° 15'

94° 00'

LEGEND

- Paved Road
- Improved Road
- Dirt Road
- Railroad
- Town or Community
- Recording Stream Gauge
- National Forest Boundary
- National Forest Land (Federally Owned)
- Drainage
- Watershed Boundary
- Floodwater Retarding Structure
- Multiple Purpose Structure
- M-Municipal
- Drainage Area Controlled by Structure
- Area Benefited
- Structure Site Number
- Channel Improvement

SITE NUMBERS AND DRAINAGE AREAS IN ACRES

No.	Area	No.	Area
1	2048	10	6099
2	4621	11	7731
3	941	12	4179
4	2861	13	3174
5	6320	14	1364
6	4614	15	8732
7	909	16	5069
8	2195	17	1997
9	2323	18	2291
		19	7654



Figure 5
PROJECT MAP
POTEAU RIVER WATERSHED
SCOTT COUNTY, ARKANSAS AND LEFLORE COUNTY, OKLAHOMA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LITTLE ROCK, ARKANSAS

Approximate Scale
0 1 2 3 4 miles
Approximate Area - 187,460 Acres

Base compiled from county maps and USGS quadrangle sheets:
Waldron, Ark. - 1939, Housheer Mountain, Ark. - 1958, Loring, Ark. - 1958,
Goulton, Ark. - 1958, Bates, Ark. - 1958, Heavner, Okla. - 1958.

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